ADDITIONAL COMMENTS ON EPA'S REVISED FS SECTIONS 3 AND 4

The Lower Willamette Group's (LWG) Significant Issues (SI) comments were submitted to the Environmental Protection Agency (EPA) on September 8, 2015. In addition, the LWG provided detailed comments on FS Sections 1 and 2 on June 19, 2014; January 2, 2015; March 25, 2015; and April 23, 2015. This memorandum contains additional comments on EPA's Portland Harbor Site (Site) Feasibility Study (FS) Section 3 dated July 29, 2015 and Section 4 dated August 18, 2015. In some cases, the additional comments refer to the September 8 SI comments or Sections 1 and 2 comments for more detail to support the additional comment(s). Omission of any SI, Section 1, or Section 2 comment or point in the additional comments contained herein is not intended to minimize or retract any of the LWG's previous comments.

1 SECTION 3 COMMENTS

1. Page 3-1 states, "This section presents the strategy used to develop, present, and screen remedial alternatives to address contaminated sediments at the Portland Harbor Superfund Site." Section 3 provides insufficient information to adequately describe EPA's strategy or rationale in general for development and screening of the alternatives. However, EPA appears to provide details of fully formed alternatives. See SI comments 1 through 12, 16, 18, and 19 for supporting information.

2. Page 3-1 states, "Alternatives were developed for the Site in accordance with CERCLA, the NCP (40 CFR §300.430), EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA 1988), Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA 2005), and Guide to Principal and Low Level Threat Waste (USEPA 1991)." The alternatives development process and the resulting alternatives are inconsistent with these guidance documents in many respects. See SI comments 1, 2, 3, 5, 8, and 9.

3. Page 3-1 states, "This FS uses a combination of the remedial technologies identified in Section 2.4." Per SI comment 1, EPA did not follow guidance (EPA 1988 and 2005), which calls for alternatives that compare one remedial technology to another as applied to the same area of sediments. This comment also applies to all of Section 3.3.2.

4. Page 3-1 states, "The concept of principal threat was developed by EPA in the NCP [National Contingency Plan] to be applied on a site-specific basis when characterizing source material (USEPA 1991)." Per SI comment 2, EPA guidance and precedents at other sites do not indicate that Principal Threat Waste (PTW) must be identified at all sites. Although the guidance indicates that PTW identification should have site-specific elements, it does not state or imply that the entire basis for PTW identification should be determined on a site-specific basis. The PTW determination should be consistent with the definitions in the guidance as applied to any site such as "Source material is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, to surface water, to air, or acts as a source for direct exposure.", and "They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compounds."

5. Page 3-1 states, "Further, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur." This is an accurate recitation of the guidance, but per SI comment 2, later in this section EPA incorrectly defines some materials as PTW even though EPA's own analysis shows that those materials can be "reliably contained."

6. Page 3-2 states, "EPA guidance (USEPA 1991) does provide that where toxicity and mobility of source material combine to pose a potential risk of 10^{-3} or greater, generally treatment options should be evaluated." However, this guidance is clear that "'source material' is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, to surface water, to air or acts as a source for *direct exposure*" [emphasis added]. This part of guidance is quoted by EPA in the first paragraph of Section 3.2. The guidance clearly states that direct exposure is the pathway relevant to PTW determination, not indirect pathways. EPA incorrectly uses the bioaccumulation pathway to determine 10^{-3} risks for the highly toxic determination. See SI comment 2. Also, in actual practice at most recent large sediment sites, PTW is appropriately not formally defined in order to address this guidance, including at the Lower Duwamish Waterway site, which has higher concentrations of many contaminants than the Portland Harbor Site. Therefore, EPA is not required to make a formal definition of PTW in Portland Harbor. In addition, as discussed in SI comment 2, the LWG has previously provided several examples of other sites where concentrations of materials identified for Portland Harbor as PTW were not subject to in situ or ex situ treatment. This comment applies to similar statements later on page 3-2.

7. Page 3-2 states, "In addition, waste contained in drums, lagoons or tanks, or free product [light non-aqueous phase liquids (LNAPLs) or dense non-aqueous phase liquids (DNAPLs)] containing contaminants of concern are also considered PTW." Per SI comment 2, EPA incorrectly paraphrases the guidance, which describes "pools of NAPL." EPA then uses this incorrect interpretation to define the presence of NAPL based on any trace observations of potential NAPL (e.g., "blebs and globules" per page 3-2) as PTW. (This approach may result in including substances that may represent false positive indications of the presence of trace NAPL). These traces do not equate to "pools of NAPL" as described in the guidance. This comment applies to similar statements about NAPL later on page 3-2.

8. Page 3-2 states, "NAPL observed offshore of the Arkema site contains chlorobenzene and DDT (dissolved)." Per SI comment 2, chlorobenzene or DDx NAPL have not been identified offshore of the Arkema site during extensive testing conducted to date.

9. Page 3-2 states, "Figure 3.2-1 identifies locations where NAPL was observed in sediments offshore of the Arkema site and Figure 3.2-2 identifies the NAPL observed in sediments offshore of the Gasco site." Per SI comment 2, these figures do not accurately indicate the presence of NAPL at either of these sites. EPA's FS does not describe how these areas were identified using site data or core observations and the figures are inconsistent with EPA's previous determination of the extent of substantial

product at the Gasco sediment site based upon site-specific investigations (e.g., Anchor QEA 2012).

10. Pages 3-2 and 3-3 state, "The following COCs [chemicals of concern] were identified at concentrations exceeding a 10^{-3} risk level at the site…The highly toxic PTW concentrations are presented in Table 3.2-1. Surface sediment areas exceeding one or more PTW highly toxic concentration levels are presented on Figure 3.2-3." EPA's FS does not describe how the values in Table 3.2-1 were calculated (e.g., based on which risk scenarios or receptors). Also, per SI comment 2, because many of the Preliminary Remediation Goals (PRGs) in Section 2 are technically incorrect, the 10^{-3} risk values associated with those PRGs and presented in this table are also incorrect. And per comment 6, the indirect bioaccumulation pathway is not applicable to a PTW determination.

11. Page 3-3 states, "Stabilization or solidification may be used to address PTW underneath and around pilings, docks, berthing or mooring dolphins, and other structures servicing active wharfs or shore-based facilities that remain intact." It is unclear whether this technology is being cited as another type of in situ treatment across the entire Site or for areas around structures only. Does this mean that other in situ treatments noted in this section are not suitable for these areas?

12. Page 3-3 states, "In the federally-authorized navigation channel and FMD areas, in-situ treatment is not compatible with current or future uses due to high flows, turbulence, and the need for future maintenance dredging; thus, in-situ treatment is not considered in these areas." The LWG generally agrees that placement of material in the navigation channel and Future Maintenance Dredge (FMD) areas is not feasible because these materials could interfere with vessel navigation. However, in situ treatment or similar materials should not be screened out due to general assumptions about flows or turbulence. Such determinations should be based on site-specific hydrodynamic and propwash evaluations.

13. Page 3-3 states, "For PTW material that is removed, four treatment technologies were retained for assignment and further evaluation, particle separation, cement solidification/stabilization, sorbent clay solidification/ stabilization, and low temperature thermal desorption (see Table 2.4 2)." Per the 2012 draft FS, the implementability of these four treatment options, as proven for large sediment volumes, varies widely across these options. Although EPA screens in these technologies, EPA never discusses the relative implementability and other issues related to these technologies before selecting low temperature thermal desorption (LTTD; one of the most expensive and unproven technologies of the four) for FS alternative development. [1] LTTD should not be retained in Section 2 screening evaluations because, as discussed in the 2012 draft FS, LTTD does not effectively treat

[1] See EPA guidance on the Portland Harbor Feasibility Study (March 28, 2008) at p. 6: "The goal of the initial screening is to gather general information on the cost, effectiveness and permanence and implementability of remediation technologies potentially applicable to the site. The goal is to develop a menu of technology options that can be applied on an SMA basis."

PCBs and high-molecular weight PAHs. Although EPA does not specifically target PCBs for LTTD treatment, PCBs will often also be present in materials that EPA indicates require LTTD treatment for other reasons.

14. Page 3-3 states, "The SMAs represent areas of localized concentrations of surface sediment contamination identified during the RI [Remedial Investigation] where MNR is not considered to be effective in reducing concentrations of COCs. Therefore, containment (capping) or removal (dredging) technologies will be considered in these areas to reduce risks." This is opposite of the correct way to define Sediment Management Areas (SMAs). SMAs are where active remedial technologies are applied.[2] Monitored Natural Recovery (MNR) is often effective in these areas as well. It is a management decision to accelerate MNR across wider areas of the Site by actively remediating select areas of higher concentration sediments.

15. Page 3-4 and Section 3.3.1 describes the identification of SMAs. EPA does not include sufficient information to understand the process.

16. Page 3-4 states, "The focused COCs are used only for the development of the SMAs; all COCs will be considered during the detailed evaluation of remedial alternatives presented in Section 4." Section 4 does not present information for every chemical presented in the Section 2 COC and PRG tables.

17. Page 3-4 states, "The distribution of these focused COCs encompasses the majority of the spatial extent of contaminants posing risks as identified in the baseline risk assessments." This statement is unsupported (e.g., no maps or other analyses are presented), particularly given that EPA did not include the comprehensive benthic risk areas from the 2012 draft FS, which were based on a detailed Baseline Ecological Risk Assessment (BERA) evaluation of a large number of contaminants of potential concern for benthic toxicity. Proving the ability of the focused COCs (i.e., the Remedial Action Level [RAL] chemicals) to address the other COCs is a critical technical evaluation that is missing from the FS. This was included in the 2012 draft FS.

18. Page 3-4 states, "The RALs were developed considering the relationship between the spatial extent of contamination exceeding the RAL concentration (acres of capping or dredging) and the surface-area weighted average concentrations (SWACs). With the exception of DDx, this relationship was calculated on a Site-wide basis. The RAL curves for each focused COC are presented in Figures 3.3-1 through 3.3-6. A range of RALs consisting of six different concentrations was developed for each focused COC decreasing from B through G." This raises several issues:

    a. EPA does not explain any relationship between development of the RALs and risk reduction at relevant exposure scales defined in the Baseline Risk Assessments (BLRAs). As the text quoted above makes clear, the RAL development focuses on reduction in Site-wide SWACs. In the absence of any

[2] See EPA guidance on the Portland Harbor Feasibility Study (March 28, 2008) at p. 9: "Identify area requiring active remediation through 'hilltopping' or similar techniques."

linkage to the BLRAs, or risk in general, the resulting RALs do not allow for any meaningful comparison of the alternatives in terms of risk reduction. For example, EPA's rolling river mile figures in Section 4 show that in many regions of the Site, EPA's PRGs are often met or overachieved by Alternative B RALs, and as a result, the lower RALs provide no additional reduction of unacceptable risks in these areas.[3]

b. No rationale is provided for evaluating DDx in a different manner than the rest of the RAL chemicals, and this is an arbitrary handling of this COC.

c. The spatial scales selected across all RAL chemicals is arbitrary in that it does not consider the spatial scales of the PRGs, which are plotted on the RAL curves and compared to these SWACs. For example, the PAH PRGs (if properly applied) are all relevant to smaller than Site-wide spatial scales. Also, it is unclear how these SWAC spatial scales relate to the Sediment Decision Unit (SDU) assessments made later in the section.

d. As another example, EPA's DDx PRG appears to be from the 6.1 µg/kg value in the Section 2 PRG tables, which is for subsistence fisher (Site-wide exposure). EPA then compares SDU SWACs to that PRG, without explaining why every SDU would need to meet or approach that Site-wide PRG in order to achieve acceptable risks for this scenario.

e. The origin of the background values and PRGs on the RAL curves is unexplained, and per LWG Section 2 comments, the values substantially underestimate the concentrations to which the Study Area is expected to equilibrate.

f. EPA does not explain why the "site area" fluctuates widely across these RAL curves given they are purported to be on a "Site-wide" basis (which is approximately 2,200 acres).

g. The source of the Method Detection Limits (MDLs) in these figures is unexplained. For example, for dioxin/furans the MDLs in the FS database range widely across different sampling programs. It is unclear how EPA selected a single MDL across these ranges.

h. The dioxin/furan RALs do not achieve meaningful reductions in dioxin/furan SWACs and are unnecessary for development of effective remedies. See SI comment 3 for more details.

i. Also, the last sentence in the text quoted above is not true for dioxin/furans, where fewer concentration thresholds were developed by EPA.

[3] As discussed in later comments, these graphs are also not presented on spatial scales that are relevant to the BLRA exposure scales and there are other technical issues with EPA's PRGs. Nonetheless, as a general approximation, the graphs still show that in many cases Alternative B RALs are more than sufficient to achieve concentrations below EPA's PRGs over many areas of the Site.

19. Page 3-4 states, “The point on the curve where further reductions in SWAC concentrations results in minimal increase in acres capped/dredged.” Functionally, this explanation is backwards. Increases in acres capped/dredged results in reductions in SWACs.

20. Page 3-5 states, “Marginal Incremental Reduction of the SWAC. The point on the curve where further increases in acres capped/dredged do not result in discernable reductions in SWAC concentrations. The G RAL was identified prior to reaching this point on the curve.” Examination of the RAL curves indicates that in almost every case the Alternative G RAL is well beyond the point where there is very little SWAC reduction for each additional acre remediated. In general, there is little explanation for why Alternative G RALs should be selected so far out on the end of the RAL curve.

21. Page 3-5 states, “Knee of the Curve. The inflection point of the curve where incremental increased acres capped/dredged becomes greater than the incremental reduction of the SWAC. The E RAL was identified at this point.” The E RALs do not generally fall at this point for all COCs. For PCBs, the E RAL is on the upside of the knee, and for TPAH, the E RAL is on the downside of the knee. For the DDx Site-wide RAL curve, RAL E is well on the upside of knee, and on the DDx SDU curve, this RAL point is on the downside of the knee. The dioxin/furan RAL points vary substantially as well.

22. Page 3-5 states, “Spatial Distribution. An additional two points (RALs C and D) were identified on the curve that were spatially distributed between points B and E and another point (RAL F) was identified between points E and G.” This does not explain where between these points EPA selected and why.

23. Page 3-5 states, “The selected total PAH RALs and the resulting SWACs and acres are in Table 3.3-2. The location of these total PAH RALs is presented on Figure 3.3-8.”

    a. The total PAH (TPAH) RALs are compared to a TPAH PRG of 970 µg/kg. No such PRG is found on EPA’s Section 2 PRG lists, and the FS does not explain the derivation of this PRG.

        i. To the extent the 970 ppb is an attempt to convert the cPAH direct contact PRG for Remedial Action Objective (RAO 1) to a TPAH value, the conversion methodology has no technical basis. TPAH concentration is not a reliable indicator of toxicity or risk requiring active remediation at Portland Harbor, because the relative toxicity of cPAHs and other PAHs vary by orders of magnitude across the human health scenarios and ecological receptors. For example, an elevated TPAH concentration could be a result of non-carcinogenic PAHs that may present relatively little risk to human health at the Site. Given these variations, an appropriate RAL should be derived that has a clear relationship to the risks as evaluated and determined in the BLRAs.

        ii. Apart from the conversion methodology, the underlying cPAH PRG is technically incorrect because EPA does not use the appropriate “site use factor" for sediment direct contact as described in the Baseline Human Health Risk Assessment (BHHRA). To be technically correct, this PRG should be four times higher. The LWG previously commented on this issue in Section 2 comments.

b. The FS does not include any demonstration of how COCs are addressed by the selected RALs. In the absence of this analysis, the LWG assumes that the TPAH RALs are intended to address risk from PAHs.

c. The only TPAH sediment PRG from EPA's Section 2 is the RAO 5 value of 23,000 µg/kg intended for protection of the benthic community. This is a generic literature value, which does not consider any of the Site-specific toxicity evaluations from the BERA. This is inconsistent with the BERA, which addressed benthic risk through a multiple lines of site-specific evidence, rather than through individual generic toxicity thresholds.

   i. Based upon Table 4.2-1, only two SDUs appear to exceed the RAO 5 TPAH PRG on a 1-mile SWAC, and the estimated post remediation concentrations drop below the PRG by Alternative D. However, Table 4.2-1 indicates that RAO 5 will not be met in the navigation channel, even by Alternative G. To the extent this conclusion is driven by the RAO 5 PRGs, this appears to be the result of one or two samples driving a 0.2-mile SWAC exceedance in a limited area. And yet EPA is applying these RALs to identify SMAs in the more aggressive larger alternatives well downstream of this area (even potentially downstream of the Study Area). This demonstrates that the TPAH RAL is not a very useful tool for addressing benthic risk in the navigation channel. For this reason, EPA should revert to the more robust Comprehensive Benthic Risk Area (CBRA) that was developed consistent with the BERA and presented in the 2012 draft FS, which did in fact identify and address the area of the 0.2-mile TPAH SWAC shown in EPA's residual risk assessment.

d. EPA has acknowledged that no technically valid sediment carcinogenic PAH (cPAH) PRG can be calculated for fish consumption under the bioaccumulation RAO 2 because EPA was only able to calculate a bioaccumulation PRG based on shellfish consumption. The LWG has presented in Section 2 comments why it is technically inappropriate for EPA to identify such a PRG as relevant to measuring fish consumption risk reduction. Therefore, to the extent the TPAH RAL is intended to address areas of cPAH risks, it should not be applied outside areas where technically valid cPAH PRGs address potentially unacceptable risk, i.e., nearshore areas where people may come into direct contact with sediments or where they may harvest shellfish.

   i. Even if the application of the cPAH PRG for RAO 2 in the navigation channel were correct, Table 4.2-13 shows that the cPAH PRG for RAO 2 is met in both River Mile (RM) 6 West and RM 6 Navigation Channel

SDUs by Alternative B. Why then does Table 4.2-1 state that Alternative D is required to meet the PRG in the RM 6 West and Navigation Channel Areas? And how does application of an Alternative RAL B that meets PRGs in all areas provide for a meaningful comparison to the remaining alternatives, which all have lower TPAH RALs?

e. Even if the cPAH PRG for fish consumption was a technically correct PRG and applied on a whole 1 RM basis consistent with the BHHRA, this PRG would be achieved without any application of the TPAH RAL in the navigation channel following reduction of the shoreline concentrations to achieve the direct contact cPAH PRG in RM 6W and reduction of benthic risk via the CBRA approach.

f. All of this demonstrates that the TPAH RAL provides no legitimate foundation for remedy selection, especially in the navigation channel, and EPA should revert to using the cPAH (as BaPEq [benzo(a)pyrene toxicity equivalents]) RALs (applied in shoreline areas) and the CBRAs (applied everywhere) presented in the 2012 draft FS.

24. Figures 3.3-08 through 3.3-12 present the SMAs defined by plotting the EPA-selected RALs on surface sediment contours. The contouring and mapping procedures appear to create a number of mapping artifacts that are not explained, although the overall mapping method is briefly explained on page 3-6. For example, Figure 3.3.-8 shows a long thin area of SMA associated with RAL B (and other RALs) that extends along the navigation channel line from approximately RM 5.8 to 6.3. This long thin area appears to be produced mostly by the assumption of splitting the contouring procedure at the navigation channel line. EPA does not indicate whether such mapping artifacts are potentially important or should be refined in remedial design.

25. Page 3-5 states, "Several dioxin/furan PRGs are below the method detection limit (MDL). In addition, the low density of dioxin/furan samples requires interpolation across large areas where no data are available, creating a greater likelihood that specific locations within a designated RAL footprint is a 'false positive.' Because the PRGs are below the MDL, the interpolation process will essentially 'map' the entire site. This necessitated an alternate approach in the development of the dioxin/furan RALs for the FS, which is described below." Per comment 18, it is unclear which MDLs EPA is using and how they were selected. Also, per SI comment 3, the low density of detect results for dioxin/furans is a reason for EPA to not select dioxin/furan RALs for the FS, not a reason to use arbitrary RAL selection methods to try to overcome this data limitation.

26. Page 3-6 states, "The selected DDx RALs were determined based on consideration of the distribution of surface sediment contamination within the localized area of RM 6.6 – 7.8 west and evaluated on a site-wide basis." EPA does not explain why these spatial scales were selected or how they relate to the exposure scales of the BLRAs. Despite the limited information available, the LWG believes the spatial scales

used by EPA do not relate to the BLRA spatial scales in most cases (see SI comment 3). EPA should use approaches that are consistent with the BLRAs.

27. Section 3.3.2 and Appendix C—See SI comment 1 for significant issues related to most aspects of this technology selection process. Also, such an approach should not be used or refined for use in the Record of Decision (ROD) to describe the Remedial Design (RD) process. See SI comment 1 for more details. Every instance of a specific disagreement is not necessarily listed here given the global nature of LWG's concerns.

28. Page 3-6 states, "The second step transforms segmented and isolated pixel-level technology assignments (resulting from a strict interpretation of the GIS output) to a predominant technology assignment by applying a smoothing algorithm that eliminates some of the small scale variability in the output and assigns a technology to the majority of the pixels within each SMA." The smoothing algorithm method and when it is applied in the FS process is not explained, making the process difficult to understand. For example, how does the smoothing algorithm relate to reasonably constructible areas (e.g., areas of intermixed dredging and capping) such as the subSMAs presented in the 2012 draft FS? Even for FS purposes, the technology assignments should represent a reasonable approximation of constructible alternatives.

29. Page 3-6 states, "The technology assignment decision tree (Figure 3.3-14a) provides two off-ramps for areas that are within the federally-authorized navigation channel (navigation channel) or designated as future maintenance dredge (FMD) and areas that have been subject to final EPA remedies." However, the later technology decision trees (Figure 3.6-1) indicate that the scoring matrix shown in Figure 3.3-14 is only used in the selection of remedial technologies for the "intermediate" depth areas. So, there are more "off ramps" than indicated by this text.

30. Page 3-7 states, "Separate NPL [National Priorities List] sites within the Portland Harbor Site, Gould and McCormick and Baxter, where a final remedy has been implemented have been excluded from this analysis. This exclusion applies solely to the McCormick and Baxter site where the cleanup action included placement of a sediment cap." These two sentences contradict each other, so it is unclear which sites were included or excluded from the FS analysis.

31. Page 3-7 states, "The multi-criteria decision matrix was developed as a non-biased and reproducible method for assigning capping and dredging technologies based on site characteristics." For reasons detailed in SI comment 1, EPA's approach is biased and not reproducible.

32. Figure 3.3-14 is unclear as to the definition of an "armored cap" vs. a "cap." Per SI comment 1, EPA has created an artificial distinction in types of caps that is inconsistent with the concept of a fully engineered cap as described in guidance (Palermo et al. 1998). Also, many of the criteria definitions and scores shown in this figure are technically incorrect for reasons detailed in SI comment 1. This comment applies to all text related to this figure.

33. Page 3-7 states, “EMNR and engineered caps were scored equally, and were not considered appropriate in wind and vessel induced wave zones, where slopes are greater than 15 percent, and in propwash zones.” In this text, EPA uses a different term than Figure 3.3-14 (i.e., the figure says “caps” and the text says “engineered caps”), which makes the relationship between the text and figure unclear. In addition, these technologies are not reasonably scored for reasons detailed in SI comment 1. Further, there is no reason to consider Enhanced Monitored Natural Recovery (EMNR) and engineered caps equal, given they are clearly two different technologies (including the engineering and stabilization components of capping). Per above, EPA appears to be assuming that engineered caps do not include engineering to resist erosion or stand on certain slopes, which is inconsistent with the definition of an engineered cap in guidance (Palermo et. al 1998). This comment applies to other areas of text where engineered caps, or caps, or “unarmored sediment caps” (e.g., page 3-8) are discussed.

34. Page 3-7 states, “The values assigned for each criterion were then summed for each technology and the technology with the highest total score was assigned to the pixel.” Per SI comment 1, this method ignores the relative scores across the technologies and picks a single technology even if two technologies score very closely, indicating they both could be potentially feasible in the area in question. The rationale for such an approach is unclear.

35. Page 3-8 states, “The 2-year return interval was considered reasonable because it delineates areas that are routinely impacted by a flow event rather than areas that rarely experience flows that exceed the shear stress of the bedded sediment.” The text does not explain why a 2-year return interval is more reasonable, than for examples, 1 or 5-year return intervals, which makes the rationale here unclear.

36. Figure 3.3-19. It is unclear whether EPA has considered areas that have undergone dredging in recent years in its analyses. Some areas that have undergone dredging are shown as “erosional” in this figure (for example, Terminal 4 Slip 3).

37. Page 3-8 states, “If an area is considered erosional, dredging is scored higher (more favorable) than capping, which in turn is scored higher than a thin sand layer associated with EMNR because sediment caps can be designed to withstand erosive forces.” This contradicts the text noted in comment 33 that indicates capping and EMNR were scored “equally.” Also, per previous comments, sediment caps are typically designed to withstand 25- to 100-year flow events. So, the reason for the artificial distinction between caps and armored caps and scoring such caps lower based on a much smaller 2-year event is inconsistent both internally and with guidance. This makes the approach biased against capping.

38. Page 3-9 states, “Based on the accuracy of the surveys (+/- 0.5 feet) and the time frame being considered (7 years or 5.67 years depending on whether the January 2002 or May 2003 is selected as the initial survey date), the minimum detectable sediment deposition rate was estimated to range between 2.2 and 2.7 cm/yr…Depositional processes over time are assumed to have led to cleaner sediments overlaying more contaminated sediments.” EPA’s bathymetry analysis is technically flawed in multiple

respects as detailed in SI comment 8c. Regarding the last sentence here, it is unclear why an assumption is needed, given the Site data clearly indicate this is true, as summarized in SI comment 8.

39. Page 3-9 states, "If an area is considered depositional, capping is scored higher than dredging indicating that depositional environments are conducive for containment technologies that rely on isolation." Again, this text ignores that engineered caps can be engineered in either depositional or erosional areas (with appropriate armoring). This rule has no bearing on the actual ability or feasibility of caps to be applied in a wide range of areas. Also, given that dredging (for navigation maintenance reasons) is routinely focused on exactly these types of depositional areas, it is also unclear why dredging would be scored lower in these situations.

40. Page 3-9 states, "Water depth in nearshore areas was also considered due to the potential loss of shallow water habitat, increase in the flood rise zone, and the conversion of submerged lands to upland following placement of material in the river. The shallow water criterion of 4 feet NAVD88 [North American Vertical Datum] was based on an assumed cap thickness of 3 feet (if capping were to be applied) and a MLLW [Mean Lower Low Water] elevation of 7 feet NAVD88. This will allow for maximum thickness of material placed in the river that remains submerged at the MLLW. While there may be opportunities to place material above the 4 feet NAVD88 elevation, they would likely require special design considerations and are best addressed as part of remedial design rather than as part of the technology assignment scoring approach." The issues of habitat, flood concerns, and submerged lands are much better addressed in remedial design per SI comment 7. Further, 4 feet NAVD88 is a low water mark that has never been observed on the river based on the Morrison Bridge Gauge data (see EPA's Appendix C for a summary of historic water levels). EPA is protecting against a low water condition that has never been known to occur at the Site. Water levels at the 7 feet elevation occur with an approximate 10 percent frequency. Thus, EPA's definition of caps that would create new land would actually be submerged 90% of the time, which is actually very high quality aquatic habitat as described in the 2012 draft FS Appendix M. Finally, we agree that there may be opportunities for better approaches in remedial design, and by extrapolation, this entire technology assignment approach will not be predictive of the actual future remedial designs.

41. Page 3-9, where discussing the scoring of shallow areas, states, "Therefore, dredging is scored higher than EMNR or capping (which is scored as neutral), followed by armored caps." Aside from the artificial distinction in cap types noted previously, it appears that EPA is assuming that armored caps would be thicker, but that is not necessarily the case. The cap design guidance (Palermo et al. 1998), which is not discussed in the FS, would need to be followed to determine the appropriate cap thickness.

42. Page 3-10 states, "At slopes between 15 and 30 percent, dredging and armored capping were scored equally, recognizing that both would encounter some but not a substantially different degree of challenges associated with implementation. At slopes

greater than 30 percent, armored capping was scored less than dredging, recognizing the impact of slopes on cap stability and the increase in design considerations to offset the impact. EMNR and engineered caps were not considered on slopes greater than 15 percent because of the potential lack of stability and impact on performance." Again, the distinction between "armored caps" and "engineered caps" is artificial and inconsistent with guidance (Palermo et al. 1998). Armoring does not necessarily add any stability to underlying cap layers on slopes, so the distinction that "armored caps" might perform better on steeper slopes as compared to "engineered caps" is incorrect. By "engineered caps" EPA appears to be referring to caps that are not in fact engineered for slope considerations, which would not qualify as an engineered cap per guidance. Thus, the type of cap being scored here (i.e., it appears to be an assumption of just layers of sand, gravel, or similar materials) would never be proposed or built anywhere on the Site. Also, the detail provided is insufficient to understand what "challenges" of dredging on slopes are being considered here.

43. Page 3-10 states, "However, there are currently no identified areas in the site where areas of cobble, rock, or bedrock are present, and therefore scoring was not affected." This text appears after a paragraph of explanation on the impacts of these materials on various remedial technologies. This raises the question as to why this criterion is even discussed in Section 3.

44. Page 3-11 states, "Erosion due to propwash can limit the effectiveness of EMNR and may also require special design considerations for capping." The type of capping being referred to here is unclear. Again, guidance indicates that caps must be designed to withstand propwash and other erosional forces (Palermo et al. 1998). Thus, it is unclear whether this refers to EPA's artificial distinction of "engineered caps" (which EPA appears to assume have no engineering components) or "armored caps," which, by definition, would be designed to withstand erosional forces and should not be scored lower in propwash zones. Further, the overall approach appears biased. In the case of dredging, EPA often assumes necessary design considerations and process options are an integral part of the technology and dredging is scored higher despite these design considerations. For example, the scoring criteria do not recognize that deeper contamination is more difficult to remove and may not be fully removed by dredging, which is a clear implementability issue related to dredging. In contrast, with capping EPA assumes that an integral part of a typical design (in this case armoring) makes capping somehow more difficult or complex in certain situations.

45. Page 3-11 states, "However, the modeling indicated a maximum disturbance depth of over 6 feet. Further, up to 3 feet of scour was estimated to occur at the U.S. Moorings site within Portland Harbor during a 2003 sediment investigation (URS 2003)." The relevance of the depth of propwash disturbance to the scoring of technologies is unclear. The implication appears to be that deeper disturbance inhibits caps to a greater degree. However, cap armoring is designed based on the calculated erosive force on the surface of the sediment or cap, not the depth of disturbance created if the armoring was not present.

46. Page 3-11 states, “Propwash has the greatest impact on EMNR, caps, and in-situ treatment because the erosive forces can erode and disperse thin layer sand covers and in-situ treatment amendments. As a result, EMNR and engineered caps are not considered viable in propwash zones. However, armored caps can generally be designed to prevent propwash-induced erosion, and it is not a significant factor for dredging (although propwash-induced erosion must be considered for any thin layer covers for residual management). In propwash areas, dredging is scored higher than armored capping, followed by EMNR/capping.” It is unclear what sort of caps are being referred to in the first two sentences (i.e., referred to as “caps” in the first sentence and “engineered caps” in the second sentence). Again, EPA has created an unclear and artificial distinction that caps might not be designed to withstand erosion, which is inconsistent with guidance (Palermo et al. 1998). Thus, equating engineered capping (which includes armor components as necessary) to EMNR and in situ treatment is incorrect. Also, engineered caps (which EPA refers to as “armored caps”) are viable in propwash zones depending on the propwash forces present and whether armoring can be adequately designed to resist those forces. Also, given the prior sentences, the final sentence does not logically follow. If armored caps can be designed to prevent erosion as EPA indicates, then dredging should not be scored higher than “armored capping.”

47. Page 3-11 states, “Because the sidescan sonar survey identified pilings as well as debris, sidescan sonar targets classified as pilings were classified as structures.” This sentence is unclear. Why does the identification of pilings as a component of debris necessitate classifying pilings as structures? Submerged and disused pilings identified by the side scan sonar survey are not structures, and it is unclear why EPA chose to classify them as such.

48. Page 3-12 states, “There are three scoring outcomes: a technology receives the highest score; technologies are tied; or an area does not receive a score (an outcome when the area does not achieve the threshold for any of the criteria). When scores are tied, the tie goes to the least intrusive remedy; EMNR and capping are less disruptive than armored capping, which in turn is less intrusive than dredging.” As noted in SI comment 1, this scoring approach does not consider whether two technologies might score very closely and are therefore nearly as feasible by these measures. It also does not consider whether there is a minimum threshold where the technology might be adequately protective or implementable. This is particularly important if there are large differences in the cost, short-term impacts, or implementability of the technologies. Also, it is unclear what “does not achieve the threshold” means. It is also unclear what was finally decided for pixels where no score was developed. Again, there is the artificial distinction between “capping” and “armored capping,” and it is unclear why one of these artificial categories would be less disruptive than the other.

49. Figure 3.3-26 refers to “overlays” for further consideration, but these overlays are not discussed at all in text where the figure is cited.

50. Page 3-12 states, “Within SMAs, areas identified as EMNR have been reclassified as engineered caps due to design considerations necessary to ensure adequate isolation of

the higher contaminant concentrations." It is unclear what design considerations are being referred to. This appears to misrepresent EMNR as a technology, which is not intended to provide adequate isolation. Further, the assumption appears arbitrary given that the contaminant concentrations within SMAs varies widely for each chemical across alternatives and varies widely between chemicals present in the same location. Instead of an arbitrary rule, any scoring approach like this should consider the actual feasibility and effectiveness of these two technologies at an FS level of detail and apply the most appropriate one to each location. (Note this comment assumes that a scoring approach is used at all, and such an approach is inappropriate in general as discussed in SI comment 1.)

51. Page 3-12 states, "In addition, areas outside SMAs assigned EMNR undergo a final evaluation to determine whether, during a 25-year return flow event, the area is within a zone where shear stresses on the sediment bed exceed the shear stress of a medium sand, which is expected to be representative of thin layer cover material. In such instances capping is indicated as the assigned technology. This ensures EMNR is not applied in an area prone to erosion in the short-term." On page 3-3, EPA indicated that capping is applied inside the SMAs only. But in this case EPA is also applying caps outside the SMAs. Also, it is unclear whether EPA applied capping in these situations even if the area in question was within the navigation channel, and if not, why EMNR would be considered to be stable and effective in these cases. Further, the Figure 3.3-27 series depicting the locations of technology assignments does not distinguish between assignments made inside and outside SMAs, so there is no way to determine EPA's actual results regarding this procedure.

52. Figure 3.3-27 shows the technologies applied as a result of the scoring approach. Because EPA has not, at this point, introduced the technology decision trees (Figure 3.6-01) it appears that Figure 3.3-27 shows technology assignments prior to going through the decision tree process, which means that this figure is not showing the final technology assignments. If this figure is showing the final assignments after the decision tree process, this needs to be explained in the text. Also, as noted above and in SI comment 1, according to the decision trees, EPA does not actually use the scoring approach in the navigation areas and shallow areas. Thus, again it is unclear whether this figure is actually showing the final technology assignments or some intermediate step. Further, the figure does not show where EMNR is applied and the text does not explain why this is omitted from the figure. Also, as noted in SI comment 1, this figure conflicts with Figure 3.6-02, which EPA indicated was in error. But per above, it appears that Figure 3.3-27 is also potentially in error, or at least not clearly explained.

53. Table 3.3-1 shows acreages of dredging, armored capping, and capping/EMNR. The decision to combine capping and EMNR is confusing, given the scoring rules indicate that these two technologies were not always handled the same way. Also, the total acreages in this table are inconsistent with the total acreages in Table 3.6-1. For example, the sum of the cap acreages in Table 3.6-1 for Alternative B is 9.2 acres, but Table 3.3-1 shows a total of 23 acres of armored cap and 4 acres of cap/EMNR.

54. Page 3-12 states, “Three containment technologies were retained for assignment and further evaluation, engineered caps, reactive caps, and armored caps (see Table 2.4-2).” Again, the capping terminology is varied and undefined. The subsequent subsections discuss both “reactive caps” and “armored reactive caps.” Also, if Section 2 defines these types of caps, what does it mean when EPA refers to simply “caps” in Section 3?

55. Page 3-12 states, “A review of a variety of FS and design-level cap configurations indicates that caps for sediment sites typically range between 2 and 3 feet depending on site-specific conditions related to erosive forces, chemical isolation requirements, and habitat requirements. Cap thickness is dependent on site-specific considerations that will be addressed in remedial design.” It is unclear why the typical cap thickness is important to the FS alternative development approach, particularly given that the subsequent subsections define specific cap cross sections. The LWG agrees that cap thickness should be determined through an appropriate engineering analysis, but this applies to both FS-level evaluation and future design.

56. Page 3-12 states, “Several major considerations drive the conceptual design, cost estimates, and feasibility. The following cap designs were assumed.” The text is unclear what considerations are being referred to and how they played into the cap designs subsequently described. In general, the rationale for the cap designs in this section is unexplained.

57. Page 3-12 defines a cross section for “engineered caps” in shallow areas as “Physical Isolation Layer: 30 inches of sand” and “Stabilization Layer: 6 inches of beach mix.” EPA previously indicates that engineered caps do not include an armor layer, but a stabilization layer of beach mix (gravel/sand mixture) would provide armoring for relatively low erosive forces. Consequently, the scoring of engineered caps does not account for the actual ability of this stabilization layer to resist erosive forces of certain types and magnitudes. Regardless of the scoring methods, it is unclear why EPA would assume that a gravel/sand mixture would necessarily stay in place in shallow areas that are subject to wave action, which can produce relatively high erosive forces. Thus, EPA inconsistently scores engineered caps as better or worse under certain erosive conditions and then assigns caps to erosive conditions where the specified cap design is unlikely to be stable. For intermediate areas, EPA assumes the cap consists of 36 inches of sand. Again, this is not an appropriate cap design per guidance unless it can be shown that sand is adequate to resist all the erosive forces present in that area. Overall, the capping approach for the FS has little bearing on where caps would actually be applied and how they would be designed in each situation.

58. Page 3-13 states, “Re-deposition of fine-grained material in capped and armored areas is anticipated to occur over time, making the armored areas similar in surface grain size to non-armored areas.” The LWG agrees with this statement, and it is an important concept for the FS. However, the rest of EPA’s approach does not appear consistent with this statement. For example, given this process is expected to occur, why would engineered caps with surface grain sizes similar to deposited sediment (e.g., silts or sands) be scored lower due to potential erosive concerns?

59. Page 3-13 indicates that armored caps would consist of 24 inches of sand as the isolation layer and 12 inches of armor stone for the stabilization layer. But unarmored caps are assumed to be 36 inches of sand. It is unclear why the isolation layer would need to be thicker for unarmored caps. This comment points out internal inconsistencies within EPA's approach.

60. Page 3-13 states, "Physical isolation of contaminated sediments may require an additional reactive layer when the vertical movement of dissolved contaminants by advection (flow of ground water or pore water) through the cap is possible. In these instances, the sorptive capacity of the cap material will determine the ability to retard contaminant flux through the cap." This statement is not consistent with how guidance describes determining the need for reactive cap layers (EPA 2005). Reactive caps layers are typically determined (even for an FS level analysis) based on modeling of the combined conditions of the Site (consistent with the approach used in the 2012 draft FS). For example, groundwater seepage rates may require addition of reactive layers where chemical concentrations in sediment or groundwater plumes are high, but not when such concentrations are relatively low. Also, in all instances the sorptive capacity of the cap material determines the ability to adequately retard underlying concentrations, not just in specific situations noted in the FS.

61. Page 3-13 states that reactive layers will consist of sand with 5% activated carbon. This is an extremely high level of carbon amendment for most Site conditions and drives up the assumed costs of reactive capping for FS purposes. Per above, the amount of activated carbon necessary is typically determined by conducting cap modeling similar to the approach used in the 2012 draft FS.

62. Page 3-14 states, "PTW that can be Reliably Contained: Representative site conditions and capping options were modeled to determine the maximum concentrations of PTW material that would not result in exceedances of AWQC [Ambient Water Quality Criteria] in the sediment cap pore water after a period of 100 years. Contaminants modeled were chlorobenzene, dioxins/furans, DDx, naphthalene, PAHs, and PCBs. A description of this modeling effort is provided in Appendix D, and the results are summarized in Table 3.3-7. The areas where PTW that would not be reliably contained are presented on Figures 3.3-28 and 3.3-29." Per SI comment 2, only material that cannot be reliably contained and is either highly toxic or highly mobile meets the definition of PTW. The LWG agrees that a reliably contained analysis is a reasonable approach for an FS-level analysis, but EPA's analysis is flawed and misapplies the results of this analysis in the remainder of the PTW and technology assignment process. Also, Figure 3.3-28 shows areas that are not reliably contained that are outside the EPA-defined highly toxic and source material (i.e., NAPL) areas. Given that the PTW guidance indicates that "principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur," material that is not highly toxic or highly mobile cannot be considered PTW, even if it is not reliably containable.

63. Page 3-14 describes a reactive cap for NAPL areas that contains both 20% activated carbon as well as organoclay. The rationale for this design is not explained. Activated carbon is not necessarily effective at minimizing NAPL movement and may not be necessary (particularly at this high percentage) to isolate dissolved phase contaminants in these areas. Again, the FS-level design for caps should be determined through cap modeling and other appropriate analyses rather than simple assumptions.

64. Page 3-14 states, "Pore water seepage rates for the entire Site are not known, available information indicates rates are higher on the western side of the Willamette River due to a greater groundwater hydraulic head than found on the eastern side of the river. To account for the higher seepage rates, reactive caps or thicker engineered caps are assumed on the western side of the river or at eastern locations with similar characteristics." The first sentence is misleading, given that the RI and 2012 draft FS present detailed estimates of groundwater seepage rates based on an extensive review of available information. Again, a simple assumption is not adequate for even an FS-level analysis, and the need for reactive or thicker caps should be determined through a site-specific modeling analysis. Also, the draft RI documented periodic groundwater seepage reversals (i.e., where surface water is recharging groundwater) on the west side of the Site that reduce the overall flux of contaminant mass to the river. These types of details should be factored into the site-specific modeling analysis.

65. Page 3-14 states, "Even in instances where a groundwater plume has been controlled in the uplands, there may be a portion of the plume that has moved beyond the control point and continues to seep into the river. Accordingly, all areas with known groundwater contamination are assumed to require an in-river reactive cap to reduce the contaminant flux and limit potential exposures. Areas where contaminated groundwater may seep through riverbanks are also assumed to require a reactive cap." First, groundwater source controls at some sites are known (e.g., Gasco) to reverse groundwater gradients, which causes groundwater beyond the shoreline to move downward into the sediment and back toward the groundwater control system. Consequently, the statement about "beyond the control point" may be true in some instances, but is false in known specific instances. Thus, the subsequent assumption regarding reactive caps is not necessary in at least some areas of the Site. Further, the requirement for a reactive cap should not be based on assumptions, but rather on site-specific considerations and data including the fact that many of the contaminants in groundwater plumes attenuate at distance from the plume source. It is also unclear how EPA determines where groundwater may seep through riverbanks or where this assumption was applied in the alternatives. Also, this groundwater section does not define a reactive cap design, so it is unclear which, if any, of the reactive cap designs applied for other situations applies to groundwater plume areas. Overall, this section on groundwater implies there are considerable uncertainties regarding integrating groundwater assessments and remedies into the sediments alternatives. A more reasonable approach would be to address the groundwater contamination through upland source control actions and remedies instead.

66. Page 3-15 states, "Cap material is assumed to be placed on the river bed using either a hydraulic diffuser or clamshell bucket." The text never refers again to how these

methods relate to the alternatives evaluation, thus they do not appear to be necessary for FS purposes.

67. Page 3-15 states, "Armored caps are assumed to be placed at riverbanks where the slope exceeds 1.7H [horizontal]:1V [vertical] and at riverbanks in the main channel that are prone to erosive forces. Vegetation is assumed to be used for riverbanks in off-channel areas that are not prone to erosion and with slopes less than 1.7H:1V." It is unclear how EPA defines channel and off channel areas and no map is provided to clarify where armoring versus vegetation is assumed. Also, no rationale is provided for the 1.7H:1V slope assumption, which appears arbitrary.

68. Page 3-15 states, "Other structures (such as dilapidated, obsolete or temporary structures) will be removed prior to capping activities. All structures with their foundations in contaminated sediments or riverbank materials and not servicing active wharfs or shore-based facilities will be removed prior to capping. Structures located within Portland Harbor are shown on Figure 3.3-23. Removal of these structures will incorporate water quality controls to prevent the off-site transport of contaminated sediments." First, this does not address potential future use; a structure that is not dilapidated, obsolete, or temporary, but which is currently not in service can readily be brought into service as needed and should not be removed without consideration of future uses during remedial design. Second, this text is unclear. It suggests that only certain structures are assumed to be removed and then refers to a figure showing all structures. The final sentence indicates that all the structures in the figure will be removed, which contradicts the first sentence and the prior paragraph. Regardless, no map is provided that shows which structures are assumed to be removed and which are assumed to stay in place. Finally, the text indicating "will be removed" appears to indicate an assumption beyond FS purposes. Such a determination at this time is inappropriate and such decisions should be left to remedial design.

69. Page 3-15 states, "To allow for uncertainty in burrow depths, a bioturbation layer of a 6 inches is assumed in the conceptual design of the engineered cap." However, all the cap designs presented earlier in the section do not mention a bioturbation layer, and thus, it appears that this was actually not considered in any of the cap designs. Again, cap designs for FS purposes should be consistent with the methods in the capping guidance (Palermo et al. 1998) for all aspects of cap design.

70. Page 3-15 states, "Shallow water habitat is a critical function of the river than must be retained. Adverse effects on overall habitat are important considerations during cap design and implementation. An engineered beach mix layer is applied to the uppermost layer of all caps in nearshore areas. This layer provides habitat and stability of the cap." The use of the term "retained" is unclear. The text implies that by adding the beach mix that habitat is somehow retained. However, the existing substrates are rarely similar to the assumed beach mix and will likely return to the current substrate characteristics due to continuing long-term patterns of deposition and erosion, which is a process EPA recognizes on page 3-13 as discussed in comment 58. Also, in Appendix J, EPA assumes that all remediated areas currently have full habitat function (which is false) and that habitat function is completely lost in all dredging and cap

areas (which is also false in a large number of situations). The beach mix assumption for habitat impact minimization appears to have no relationship to 1) actual habitat functions at the Site and 2) EPA's assumptions about habitat impacts and mitigation needs in Appendix J. Further, EPA's assumptions do not consider many other factors that contribute to habitat value. For example, placement of a cap in some areas may actually convert less valuable deeper water habitat into more valuable shallow water habitat. Thus, the overall approach on habitats appears arbitrary. See additional points in SI comment 7.

71. Page 3-16 states, "In shallow areas, placement of capping material will result in positive change in the bathymetry that would require mitigation under Section 404 of the Clean Water Act, and would also affect the flood rise capacity of the river. In order to limit the need for mitigation and flood rise analyses, equivalent cap thickness is dredged prior to placement to allow for a net zero bathymetry change in shallow areas." This is incorrect. One, as shown in 2012 draft FS Appendix M, changes in bathymetry may not change the habitat function if the elevation does not change from one habitat zone to another. Also, in some cases, the addition of capping may convert a deeper, lower value habitat into a shallower, higher value habitat. Two, flood rise capacity of the river is potentially impacted by fill in all areas of the river, not just shallow areas as apparently assumed here. Further, flood rise concerns could actually be exacerbated by capping back after dredging, and as a result, EPA's assumption here is not necessarily helpful to flood rise concerns. See SI comment 7 for more details on the inappropriateness of these assumptions to address these stated concerns.

72. Page 3-16 in Section 3.3.3.6 states, "Monitoring is an integral component of capping, and will be conducted to evaluate long term effectiveness. The monitoring program will include sediment, surface water, pore water, and fish tissue samples collected at the following frequencies." There are several issues raised by the monitoring program discussed in Section 3.3.3.6:

    a. The specific type of fish and how their home range might be indicative of capping performance in a particular area is not discussed. Given that most fish evaluated in BLRAs do not have home ranges that will coincide with particular caps, fish monitoring will not provide meaningful information on cap performance.

    b. Similarly, given that surface water moves rapidly over any particular area of caps or sediment in general, it is unclear how surface water samples can be related to a specific cap's performance.

    c. It is also unclear how such monitoring can be applied in evaluating compliance by individual parties or groups of parties who construct and maintain the caps in question. Fish tissue and surface water sample monitoring should not be designated relative to a specific remedial technology like capping. However, fish and surface water monitoring can play a valuable role in assessing the performance of the overall remedy.

d. The text states that monitoring "will be conducted." It is unclear whether the text is referring to an FS assumption or a determination that has been made for future monitoring after the ROD.

e. The information provided in this section and similar information in Sections 3.3.4.2, 3.3.6.1, 3.4.2, and 3.5.2 is insufficient to understand the scope of the overall monitoring program envisioned (e.g., the numbers and types sediment, surface water and fish tissue samples). It is also insufficient to understand how EPA arrived at total "periodic costs" in Appendix G, which include monitoring costs, ranging from $337 million to $977 million. In contrast, the 2012 draft FS Appendix T provided a detailed description of the proposed monitoring program.

73. Page 3-17 states, "Environmental/closed buckets are assumed for mechanical dredging of sediments to lessen releases to the water column. Articulated fixed-arm dredges are the preferred dredging option due to the greater bucket control that can be achieved with this dredge type versus cable-operated dredges. This greater bucket control has proven to limit contaminant resuspension and release at other sediment sites (AMEC et al. 2012)." So called environmental buckets do not necessarily lessen dredging releases, particularly in difficult digging conditions as discussed in the 2012 draft FS. The statements about articulated fixed-arm dredges being "proven" are not supported by information in the reference cited, and other instances where this approach has caused dredging issues exist, but are not discussed in the FS. See SI comment 9 for more details. Also, articulated fixed-arm dredges cannot use the larger bucket sizes that cable dredges can use. A 5-yard bucket may be the maximum size possible if water depths are greater than 40 feet, for example. This is a real constraint on production rates that should be discussed in the FS. Also, although the opening paragraph to this section states that the most appropriate equipment will be determined in design and that these are only FS assumptions, the statements that certain technologies "are preferred" implies that EPA has made decisions about appropriate equipment for design purposes, which is inappropriate at this stage. See SI comments 1 and 9.

74. Page 3-17 also discusses assumptions about fixed arm and cable dredge reaches and bucket sizes, but the relevance of these assumptions to "cost estimates and feasibility evaluation" is not clear. We could not find where these specific aspects are discussed or considered further in the cost or feasibility sections in Section 4. Again, to the extent that such assumptions do not inform the FS evaluation, they can remain unstated and left to later design level decisions.

75. Page 3-17 states, "Dredge prisms are defined as the continuous three-dimensional extent of sediment planned for removal. Limited data exists on the depth of contamination at the site." The first sentence is unclear regarding the actual procedure used. For example, what does "continuous three-dimensional extent" mean? Regarding the second sentence, there is more than sufficient coring data, which was collected per EPA approved work plans, to perform an FS level of evaluation of the Site.

76. Page 3-18 states, “Consequently, a Natural Neighbors geostatistical interpolation was conducted using the existing subsurface data and assigning each pixel a depth to threshold corresponding to the deepest sediment sample with concentrations exceeding PRGs. The depth profiles within the SMAs from this interpolation are presented on Figures 3.3-36a-f. The volume of contamination in each SMA was calculated by summing the volumes (area of each pixel multiplied by its interpolated or measured depth to threshold) of the pixels in each SMA.” EPA does not appear to have determined depths to the “PRGs” because all the figures cited in this section show exceedances of RALs, but the next paragraph says, “Dredge depths will be based on the RALs.” These methods are also overly simplistic and likely underestimate dredge volumes even for FS purposes as discussed more in SI comment 6.

77. Page 3-18 states, “A maximum dredge depth of 15-19 feet is assumed since special design and side slope stabilization considerations would need to be conducted on an area-specific basis.” The reason for the variation from 15 to 19 feet, and where 15 versus 19 feet are assumed, is not further explained in Section 3. There are only later descriptions of some areas being dredged to 19 feet with no rationale provided on why those particular areas were determined to require deeper dredging.

78. Page 3-18 states, “Nearshore areas encompass special habitat considerations so leave surfaces are assumed to be at the existing elevation. Therefore, any material removed would require backfill to the existing elevation. As dredge depths increase, volumes and costs for disposal of removed material increase as well as volumes and costs for fill material. It was determined that the optimal maximum dredge depths in nearshore areas was 3 feet to allow for the assumed thickness of an engineered cap.” As discussed above and in SI comment 7, the assumption that backfilling to the existing elevation will increase the habitat value or function is not necessarily correct and does not lead to any decrease in the assumed mitigation requirements in Appendix J. Finally, the determination of the “optimal” 3-foot depth is unexplained. For example, why is 2 feet or 5 feet less optimal in comparison? Also, given that subsurface contamination is often higher than surface contamination (see surface to subsurface ratio plots in the 2012 draft FS), EPA is requiring dredging that will in some cases reveal higher contaminants that are then capped. This is potentially less effective (i.e., raising the contaminant concentrations present at the surface and creating short-term dredge releases) and more expensive than simply capping the materials in place, and per above, may provide no actual improvement in habitat value in many locations.

79. Page 3-18 states, “If contamination above the RALs extends below the maximum dredge depth, a cap will be placed over the residual contamination. Otherwise, a 1 ft thick sand layer will be placed over the dredged area to cover the exposed surface and isolate any dredge residuals and remaining contaminated sediment inventory.” Per SI comment 1, this is good reason to evaluate the depth of contamination in the scoring process for the alternatives, but EPA does not include this critical criterion in the technology assignment process. Also, the later technology assignment decision trees are inconsistent with the text description of a 1-foot thick sand layer applied post dredging. This is only one of the options shown in the decision trees in areas where

depth of contamination is greater than 15 feet. Also, in places where a cap is considered to be needed after dredging, EPA has already determined these dredging areas are not conducive to capping. Consequently, it is inconsistent for EPA to assume at this point in the process that caps are now feasible relative to all the technology scoring criteria discussed earlier.

80. Page 3-18 states, “Single pass production dredging (one dredge pass to the appropriate depth followed by confirmation sampling) is assumed for all dredging areas, which is typical of modern dredging practices.” EPA provides no citation or examples from other projects supporting that this procedure is “typical.” A wide range of dredging approaches has recently been effectively employed at other sites (details can be provided upon request). Further, the paradigm of confirmation sampling after an initial target depth is reached results in dredges having to sit idle (or be moved to another area and then potentially be moved back) while rush chemical analytical results are obtained before construction can be completed in any given area. This approach will result in project delays that are not considered in other aspects of the FS evaluation, particularly in EPA’s construction duration evaluations. Also, other potential approaches should be allowed for consideration in remedial design.

81. Page 3-18 states, “It is ideal that riverbanks have a slope less than 5H:1V for habitat considerations. Many of the contaminated riverbanks currently have slopes that exceed this optimum ratio.” EPA does not indicate why this slope is ideal for this Site or why it should be an objective of the remedial action.

82. Page 3-18 states, “Additionally, many of the contaminated river banks extend into the upland areas of the site that preclude removal of the contamination to PRGs.” It is unclear how riverbanks can “extend into the uplands” because typically riverbanks and uplands are defined as two separate areas with the riverbanks lying in between the river and the uplands. It is also unclear whether EPA intended to use the term “RAL” instead of “PRG”. The sentence should be clarified.

83. Page 3-18 states, “Consequently, caps will likely need to be placed on much of these banks and volumes are estimated by assuming that all the banks are currently vertical and need to meet a minimum slope of 1.7H:1V.” This is a broad assumption that does not adequately address for an FS level evaluation the complex integration of the sediment and riverbank remediation. Issues here include that Site riverbanks are mostly not all vertical and that no rationale is provided for the minimum slope requirement or how it was derived. Also, the description is insufficient to understand EPA’s riverbank conceptual design including where the lay back starts and stops and what elevations are being defined as riverbanks versus uplands and sediments. See SI comment 4 for more details.

84. Page 3-18 states, “Monitoring of water quality parameters will be conducted until applicable passing criteria are achieved. Monitoring programs, actions to address any water quality exceedances (such as increased dredge cycle times if water quality exceedances are resulting from dredging activities), and specific water quality criteria to be applied at the Site.” The meaning of the first sentence is unclear. Is this

describing an iterative approach where dredging will be started and stopped until water quality criteria are achieved? If so, this is unrealistic given that existing upstream surface water concentrations exceed some of the stated criteria already (e.g., the river is on the 303(d) list for several parameters) and Site sediment remediation will not change this fact. The second sentence is incomplete, and the meaning is also unclear. Overall, there is little discussion about monitoring dredge releases, which may be a fatal flaw in the proposed use of dredging.

85. Page 3-19 states, "This is best addressed accomplished with a 6- to 12-inch layer of sand applied over the dredge area as soon as possible [i.e., promptly after the design dredge elevation has been met in greater than or equal to 95 percent of the dredging work area (adapted from Louis Berger Group 2010)]." This includes a footnote that says "Per Louis Berger (2010), "[a] dredging pass will be deemed to be successfully completed in a given sub-unit once 95% or more of the subunit is at or below the Depth of Contamination (DOC) elevation." The LWG agrees that addressing residuals sooner can decrease the overall releases from dredging. It is unclear that the very specific methodology described for determining dredge completion will necessarily be appropriate at all locations at the Site or is necessary to inform the FS. Such methods are best determined in the remedial design phase. See SI comment 9b regarding this text. Also, EPA indicates here that the sand layer can be 6 to 12 inches thick, but earlier text describes that a 12-inch sand layer will be used (see comment 79). No rationale for selecting the highest value out of this range is provided.

86. Page 3-19 states, "Sediment cores are assumed to be taken through the post-dredge thin sand layer to confirm that the required layer of sand has been applied to manage residuals. These cores will be taken once the thin sand layers have been applied." The procedures anticipated are unclear, given that in earlier text EPA indicates that cores will be taken after the target dredge depth is achieved but before the sand cover is placed. If EPA is indicating that sampling will be conducted both before and after the residual layer is placed, such a procedure is highly inefficient (for reasons discussed in comment 80) and redundant. Also, although EPA may not intend this procedure, it is not the purpose of dredge residual covers to demonstrate attainment of the RALs. However, coring might be one technically valid method to confirm sand coverage. Per Palermo et al. (2008), it is understood that dredge residuals above the RALs may occur during dredging and the purpose of a dredge residual layer is to reduce residual concentrations, not isolate or necessarily sufficiently dilute the residuals to ensure that resulting surface layer meets the RALs.

87. Page 3-19 states, "Contaminant releases in the absence of a post-dredge thin sand layer and operational BMPs [Best Management Practices] are typically on the order of three percent of the total contaminant mass removed. A 12-inch sand layer is assumed for all dredge areas once 95 percent of dredging is complete (and the potential need for additional dredging passes to reach the desired dredge depth will be lessened) in an area to control residuals and releases. In areas where PTW is present, five percent activated carbon is assumed to be mixed with the residual layer." Regarding the first sentence, this statement is unsupported. EPA project memoranda cited elsewhere in the FS text do not sufficiently support this contention. It appears that this

determination was based solely on one project (Hudson River Phase 2). See SI comment 9. Per comment 85, EPA provides no rationale for the selection of the 12-inch sand layer specifically and the dredge completion methods will not necessarily be appropriate at all locations at the Site. Such methods are best determined in the remedial design phase. Regarding the last sentence, activated carbon should not be assumed just because the material removed was previously determined to be PTW. Once the PTW is removed, the activated carbon treatment serves no purpose. Also, see SI comment 1f.

88. Page 3-19 states, "Current velocities greater than 2.5 feet per second may limit the implementability and effectiveness of silt curtain controls, thereby increasing contaminant release rates/mass being transported away from the in-water work area during dredging activities (Palermo et al. 2008). However, dredging is assumed to occur during the approved in-water work window when river currents are low." The citation provided does not mention this specific water velocity. The effective use of silt curtains cannot be defined by any one velocity threshold. Palermo et al. (2008) state, "Their application in moderate- or high-energy areas can be complicated, requiring constant repair and maintenance. Further, the effectiveness of silt curtains is not fully understood. Flows typically pass below or around fabric curtains not securely fastened to the bottom." Given that effective silt curtain implementation is more nuanced than portrayed in EPA's FS, it is unclear whether summer water flows will always meet the conditions in all Site areas that EPA assumes are suitable for silt curtain usage.

89. Pages 3-19 and 3-20 state, "Silt curtains are assumed in water depths less than 50 feet and in areas where NAPL is not present. A combination of silt and bubble curtains were unable to prevent multiple water quality criteria exceedances downstream of the 2005 Gasco removal action involving NAPL (Parametrix 2006). Areas of confirmed NAPL presence and Site bathymetry are presented on Figure 3.3-37. Engineered rigid control measures (such as sheet piles) may minimize NAPL and sediment releases outside of the sheet pile enclosed work area. These measures will be incorporated into any remediation alternative involving the presence of NAPL." EPA provides no rationale or citations for why silt curtains would be feasible in deep water (i.e., 30 to 50 feet). Past project experience has shown that implementing silt curtains in deep water is difficult and complicates and slows the dredging progress (references can be provided). Further, whether or not exceedances were observed at Gasco has no bearing on whether sheetpiles would be more effective than silt curtains for reasons detailed in the 2012 draft FS dredging section. See SI comment 19 for errors in Figure 3.3-37. See SI comment 11 for issues related to sheetpile use. Also, the text is unclear whether a requirement is being established for the Site or an assumption is being presented for FS purposes only.

90. Page 3-20 states, "As evidenced by recent environmental dredging projects in the Pacific Northwest, dredging BMPs can greatly lessen contaminated sediment releases, residuals, and resuspension. The following BMPs have been effectively used at the Boeing Plant 2 portion of the Lower Duwamish Waterway Superfund Site (adapted from AMEC at al. 2012) and are assumed to be implemented at the Portland Harbor

Site." See SI comment 9, which explains that this reference does not provide information that supports EPA's statements. The listed BMPs were used at the Boeing site, but the related reports do not provide sufficient evidence that the BMPs performed as indicated either at the Boeing site or would necessarily perform as stated at the Portland Harbor Site. Again, it is unclear whether the stated assumption is for FS purposes only or is being set as a design requirement for Portland Harbor, which would be inappropriate prior to remedial design as discussed in SI comments 7, 9, and 11. Finally, as discussed in SI comment 5, guidance (EPA 2005) requires that the FS fully consider the impact of required BMPs on production rates and construction durations, which the FS text does not do.

91. Page 3-20 states, "A standard clamshell bucket, grapple, or equivalent will be used for removal of this material. Appropriate controls specifically designed for debris or structure removal (for example, 2007 Puget Sound piling removal BMPs) will be used to lessen releases and dredge residuals." Again, it is unclear whether EPA is discussing an FS level assumption or a requirement for remedial design, which would be inappropriate at this stage. Also, the reference is incomplete and could not be reviewed for accuracy and applicability to this Site.

92. Page 3-20 states, "Pilings, docks, berthing or mooring dolphins, and other structures servicing active wharfs or shore-based facilities will likely remain intact during removal activities. To the extent practicable, a fixed arm environmental bucket dredge or excavator is assumed for removal of contaminated sediments and riverbank materials located beneath and around these structures." However, EPA's technology assignment approach assigns capping to areas under docks in all cases. Consequently, the relevance of this text is unclear, and it appears inconsistent with the rest of the FS approach.

93. Pages 3-20 and 3-21 state, "Other structures (such as dilapidated, obsolete or temporary structures) will be removed prior to environmental dredging or excavation activities. All structures with foundations in contaminated sediments or riverbank materials, and not servicing active wharfs or shore-based facilities, will be removed prior to dredging or excavation. Structures located within Portland Harbor are shown on Figure 3.3-23. Removal of these structures will incorporate water quality controls to prevent the off-site transport of contaminated sediments." The text appears biased toward certain outcomes in design. For example, here EPA uses deterministic language "will be" for the more aggressive and more expensive remedy option of removing other structures, but uses more flexible language "will likely," as discussed in comment 92, when less aggressive and less expensive options are discussed. And when less aggressive options are discussed, more aggressive options are often discussed in detail anyway (see comment 92). Also, as noted previously, this statement does not address potential future use; a structure that is not dilapidated, obsolete, or temporary, but which is currently not in service can readily be brought into service as needed and should not be removed without consideration of future uses during remedial design. In addition, the last sentence appears to assume that all structures will be removed, because it references a figure that shows all structures not just "other

structures," which contradicts the first sentence that indicates only "other structures" are assumed to be removed.

94. Page 3-21 states, "Balancing of dredge and fill volumes will limit flood rise concerns throughout the Site." This is not necessarily correct. Balanced cut and fill is one short hand way to address potential flood concerns, but does not necessarily ensure no flood rise impacts will occur. For example, material could be removed from the shoreline and placed in the middle of the channel, and although balanced, could have significant impacts on mid-channel flow and cause a flood rise. See SI comment 7 for more details on appropriate flood risk evaluations for the FS. Also, again it is unclear whether an assumption for the FS or a design requirement is being stated. If an assumption for an FS, it is unclear whether any of EPA's alternatives actually meet this assumption because no balanced cut and fill analysis is presented in the document.

95. Page 3-21 states, "CERCLA, the NCP and existing EPA guidance state a preference for treatment 'to the maximum extent practicable,' an expectation that 'treatment [be used] to address the principal threats posed by a site, wherever practicable,' and a preference for treatment 'to the maximum extent practicable' while protecting human health and the environment." While this is a paraphrase of the NCP, it is clear that the EPA 2005 sediment guidance does not interpret the NCP such that sediments will be treated extensively for large sediment sites. For example, the guidance states, "For the majority of sediment removed from Superfund sites, treatment is not conducted prior to disposal, generally because sediment sites often have widespread low-level contamination, which the NCP acknowledges is more difficult to treat." The guidance is clear that MNR, capping, and dredging are the three primary technologies that are likely to be applied at most sediment sites, and that there is some opportunity for in situ treatment and addition of reactive materials to caps.

96. Page 3-21 states, "The cost to dispose of this type of PTW material in an appropriate disposal facility without treatment (excluding removal or transport costs) can typically range from $30 to $100 per ton depending on the type of facility. While treatment of these contaminants would reduce their toxicity and mobility, it would also increase the volume and costs for disposal. The additional estimated cost for treating PCB and dioxin/furan contaminated sediment or riverbank soils prior to disposal at an appropriate facility can typically range from another $100 to $600 per ton, depending on factors such as the type of facility, concentrations of the contaminants, and treatment methods used to meet regulatory requirements." The bases for these costs should be explained and referenced.

97. Page 3-21 states, "An additional evaluation will need to be conducted on dredged sediment containing any PTW related to NAPL, PAHs or DDx. Thus, ex-situ treatment is applied to dredged sediment and soil containing these contaminants." This text comes immediately after a paragraph that describes why ex situ treatment before disposal of PCBs and dioxin/furans above PTW levels is not necessary to add effectiveness to the remedy. The LWG agrees with that determination for PCBs and dioxin/furans. In contrast, there is no rationale provided for why NAPL, PAHs, and DDx related PTW requires treatment as stated here. For example, why are PAHs and

DDx sufficiently different from PCBs and dioxin/furans for ex situ treatment to be deemed appropriate for PAHs and DDx? Also, per SI comment 2, any instance of trace NAPL (as EPA has defined it for the FS) is not necessarily remediated more effectively by using ex situ treatment before disposal. Also, it is unclear what "additional evaluation" is being referred to, what it would entail, and whether it will occur later in the FS or during remedial design.

98. Page 3-22 states, "Monitoring will be conducted to evaluate contaminant releases during dredging. The monitoring program will include surface water and air samples collected at the following frequencies." The concept that air samples will be routinely necessary is unsupported and not technically accurate, given the relatively low concentrations of contaminants in the vast majority of Site sediments. EPA should provide a more detailed description using guidance (e.g., Palermo et al. 2008) for when air sampling may be needed in the future.

99. Page 3-22 discusses fish consumption advisories within the dredging subsection. Fish consumption advisories are also discussed for some other technologies (but not capping). It is unclear why EPA is linking fish consumption advisory institutional controls to each individual technology, given that such controls will be necessary as an overarching element of all the alternatives (which include all the technologies). EPA's FS text contains redundant but slightly different discussions of these controls in multiple subsections of the document, which is confusing.

100. Page 3-22 states, "The representative process options selected for each disposal technology for FS evaluation and cost purposes are: Commercial Landfills: Roosevelt Regional Landfill (Subtitle D), and Chemical Waste Management of the Northwest (Chem Waste) Landfill (Subtitle C; accepts RCRA [Resource Conservation and Recovery Act] waste)." EPA provides no rationale for why these particular upland facilities were selected for FS evaluations. In particular, the Roosevelt selection differs from the 2012 draft FS, and although not necessarily an inappropriate choice, it triggers consideration of Washington State waste regulations. Thus, these decisions are worthy of explanation for the FS to be fully supported.

101. Page 3-23 states, "This rule means that RCRA regulatory requirements do not apply to sediment dredged at the Portland Harbor Site and disposed of on-site, such as at the Terminal 4 CDF [Confined Disposal Facility], if the material otherwise meets the CDF acceptance criteria." However, the text later states on page 3-24 that "the design for the Terminal 4 CDF does not contemplate acceptance of RCRA characteristic hazardous waste due to contaminant mobility concerns." Thus, the purpose of discussing placement of such waste in the T4 CDF that specifically has design criteria prohibiting the placement of such waste is unclear and confusing.

102. Page 3-23 states, "Sediment dredged from the Site will require waste characterization to determine whether it should be classified as material containing hazardous waste under RCRA." Waste determination may be made based upon generator knowledge as well as analytical testing (40 CFR 262.11). Where investigations have established that sediments to be removed through dredging will not exhibit a characteristic of

hazardous waste when removed, and where the sediments have not been impacted by the release of a listed hazardous waste, additional analytical testing may not be necessary.

103. Page 3-24 states, “A review of chemical concentrations (particularly metals) across the Site indicates the potential for additional sediments to be classified as characteristic hazardous wastes based on the RCRA toxicity criteria.” The methods and results of this review are not further explained in Section 3. As a result it is unclear what materials are assumed to be RCRA hazardous waste for the purposes of alternative development (e.g., no figure is presented in Section 3 regarding the assumed locations of RCRA hazardous waste except for the circumstances of possible F listed waste and potential waste subject to the Oregon pesticide residue regulations only, which are depicted as generalized large circles on a map).

104. Page 3-24 states, “Therefore such [RCRA] waste will be taken off-site for disposal in the Chem Waste RCRA Subtitle C landfill unless contaminant concentrations exceed the land disposal restrictions specified in 40 CFR Part 268. In this case, treatment will be required as specified in 40 CFR §268.40 prior to disposal in the RCRA Subtitle C landfill. If sediment contaminant concentrations are less than acceptable land disposal restriction concentrations, then the material can be disposed of in the RCRA Subtitle C landfill without treatment.” This text is inconsistent with the text in Section 4, where it appears that EPA may be incorrectly using Universal Treatment Standards (UTS) values to screen sediments. See SI comment 18 regarding these issues. Also, the cost appendix (G) does not indicate if any RCRA hazardous waste was identified and assumed to be subject to treatment or Subtitle C disposal.

105. Page 3-24 states, “In addition, sediment adjacent to and downriver from the Arkema site may contain DDT-manufacturing waste residues. This material may be classified as an Oregon State-listed hazardous waste based on the Oregon Pesticide Residue Rule (Oregon Administrative Rule 340-109), and if taken off-site will be managed in accordance with the Oregon State regulations.” These sediments are not applicable to the Oregon Pesticide Residue Rule as detailed in SI comment 18. This issue applies to text discussing handling of pesticide containing sediments on page 3-25 as well.

106. Figure 3.3-40 contains EPA’s sediment and soil disposal decision tree. SI comments 2 and 18 provide most of the LWG issues and disagreements with this disposal decision framework and are not repeated here. Also, this decision tree directs all dredged material to upland or CDF disposal. This may be reasonable for an FS-level assumption, but the ROD should allow flexibility for beneficial reuse of dredged materials, if appropriate. Also, there are a number of inconsistencies and a lack of clarity with this decision tree either as a stand-alone reference or in comparison to the Section 3 text. These include but are not limited to:

    a. The “yes” arrow leading out of the upper-left-most diamond on the figure leads to steps comparing sediment concentrations to Land Disposal Restrictions (LDRs) to determine whether treatment is needed before disposal in a Subtitle C landfill. Materials following this pathway include “Waste that May Warrant

Additional Management," which footnote 1 notes is based on Toxicity Characteristic Leaching Procedure (TCLP) exceedances of otherwise exempt Manufactured Gas Plant (MGP) waste. This is inconsistent with both the text of Section 3 and the 2009 EPA order for the Gasco sediment site. In contrast to the figure, the text indicates that this material would go to Subtitle C disposal, or if treated, could go to subtitle D disposal. The LWG agrees with the text description of the process for these "Additional Management" MGP materials, except that CDF disposal of MGP waste should be allowed after treatment, while the decision tree description is not technically supported or accurate. In no event are land disposal restrictions applicable or relevant and appropriate to non-RCRA wastes, including MGP residuals. In no event are land disposal restrictions applicable or relevant and appropriate to non-RCRA wastes, including MGP residuals. See, Management of Remediation Waste Under RCRA, p. 6 (EPA530-F-98-026, October 1998).

b. Regarding the "yes" arrow leading out of the diamond labeled "PTW that cannot be reliably contained," this material can go to Subtitle D disposal without treatment as long as it is not also RCRA or Oregon listed waste. It is inconsistent to have a determination that PTW that is reliably contained (the next diamond down) should undergo treatment (i.e., "treatment expected"), while PTW that is not reliably contained should not be treated. The LWG believes that PTW, as defined by EPA, can be appropriately disposed at a Subtitle D facility without treatment in most cases (see SI comment 2).

c. Regarding CDF acceptance criteria diamond, the T4 CDF acceptance criteria on page 3-27 allow for acceptance of a wider range of materials than the decision tree allows. Specifically, the decision tree indicates that PTW containing PAHs or DDx cannot go to a CDF, while the text excludes only PTW that is "highly mobile." (Incidentally, EPA uses inconsistent terms throughout the text and figures, but it appears that "highly mobile" in the text is synonymous with "source material" in the figure.) Also, per EPA's text on page 3-23, sediment destined for a Section 404 Clean Water Act (CWA) CDF is exempt from RCRA designation and associated requirements. Consequently, placement of material that might otherwise be RCRA hazardous waste in an on-site CDF should be allowed in the decision tree and text as long as the material meets the acceptance criteria of that particular CDF.

d. The page 3-27 text indicates that free oil or NAPL containing sediments (even trace levels) are not eligible for placement in a CDF, while the figure indicates that "source material" (again assuming the terms are synonymous) can be placed in a CDF after treatment.

e. Footnote 3 discusses that sediments offshore and downstream of Arkema may contain material subject to the Oregon Pesticide Residual Rule. Low but detectable concentrations of DDx exist throughout the Site including down to and below background levels, and as a result, it is unclear how EPA will apply this footnote and determine which sediments meet this requirement. Also, as noted in SI comment 18, the EPA's interpretation of this rule is incorrect.

f. See also SI comment 19h regarding issues with footnote 1.

g. In general the figure is unclear that the Roosevelt Subtitle D landfill in Washington can accept Oregon Pesticide Waste. Also, per other comments, the sediments off site of the Arkema facility are not RCRA listed waste or Oregon Pesticide Waste and would likely be regulated as Subtitle D material under State of Washington's Dangerous Waste Regulations (WAC 173-303).

107. Page 3-26 states, "Only a small volume of dredged materials that do not meet RCRA Subtitle D acceptance criteria are expected to be generated." This statement is subjective (i.e., "small volume"), and further, it is unsupported given the extensive number of requirements in Sections 3 and 4 regarding characteristic RCRA waste; RCRA listed waste; State-listed waste; wastes that may warrant additional management; land disposal restrictions; and requirements for treatment of source material, PAHs, and DDx (given some parties may choose to skip the expensive treatment step and go directly to Subtitle C disposal).

108. Page 3-26 states, "A summary of how these standards were addressed in the T4 60 Percent Design are shown in Table 3.3-8." The LWG has the following comments on the cited table:

a. Regarding all standards, EPA should add that the T4 CDF design meets all of the standards noted here, similar to the statements EPA included in performance standard 12.

b. Regarding performance standard 16, the phrase "in perpetuity" is not necessarily consistent with the T4 60 percent design and should be made consistent with that design, which states, "The Terminal 4 engineering cost estimate assumes that 30 years of long-term monitoring of the CDF will be conducted. It is further assumed that evaluations would be conducted during CERCLA 5-year Reviews to determine whether CDF monitoring should continue beyond 30 years, or alternatively whether all or portions of the CDF monitoring program may be reduced or terminated due to early compliance."

c. Regarding performance standard 24, statements about management of interim impacts to fisheries and wildlife should be made more specific. In Section 5.10.5 of the T4 CDF 60 percent Design, it indicates that interim covers will be used in the later stages of CDF filling when water depths are shallow enough for sediments to pose a risk to wildlife.

109. Page 3-27 states, "Maximum contaminant concentrations in sediment suitable for placement in the CDF were derived in the T4 60 Percent Design (Anchor QEA 2011), and are provided in Appendix D." The meaning of this statement is unclear given that Appendix D is entitled "Principal Threat Waste Cap Modeling" and appears irrelevant to CDF maximum contaminant concentrations. If EPA is indicating that in situ cap

modeling results will be used to define acceptable CDF disposal concentrations, such an approach is technically incorrect for reasons detailed in SI comment 12e.

110. Page 3-27 states, "EMNR is accomplished through the placement of a 12-inch layer of sand, which is sufficient to allow for mixing with the underlying sediment bed, while also retaining clean sand above the mixed interval." This statement is technically incorrect. The mixed interval exists at the sediment surface, so no clean sand would be retained above that interval, by definition. Also, the statement is unsupported because EPA's assumption about the mixed interval depth is not stated here. This comment applies to similar sentence on page 3-28 as well.

111. Page 3-27 states, "In areas where PTW is present, 5 percent activated carbon is added to the sand layer." This appears to occur in areas outside the SMAs. Per SI comment 2, the concept that PTW could exist outside the SMAs generally does not make sense and is inconsistent with guidance. Also, no rationale is provided for the 5% activated carbon application rate. How was this determined? Why is it reasonable and cost effective as compared to lower application rates? Based on in situ treatment (which is procedurally identical to the EMNR with activated carbon described by EPA here) rates at other sites as discussed in the 2012 draft FS section on in situ treatment, the LWG believes the application rate could be much lower and achieve similar goals.

112. Page 3-28 discusses that sediment, surface water, pore water, and fish tissue samples will be collected for long-term monitoring of EMNR areas. For reasons stated in comment 72 regarding capping monitoring, the fish tissue and surface water sample monitoring should not be designated relative to a specific remedial technology like EMNR. Also, the text states that monitoring frequencies "will be conducted." It is unclear whether the text is referring to an FS assumption or a determination that has been made for future monitoring. Further, it is technically inappropriate to require porewater monitoring to evaluate EMNR. This technology is not intended to isolate or necessarily reduce porewater concentrations in the immediate, but rather, it is intended to accelerate the process of natural recovery of the sediments. This process can be monitored through bulk sediment chemical concentrations, which are used to determine the need for EMNR in the first place. This comment also applies to the Swan Island Lagoon EMNR discussion on page 3-28 and 3-29.

113. Section 3.3.6.2 discusses institutional controls related to EMNR including fish consumption advisories. Per comment 99, fish consumption advisories are also discussed for some other technologies (but not capping). It is unclear why EPA is linking fish consumption advisory institutional controls to each individual technology, given that such controls will be necessary as an overarching element of all the alternatives (which include all the technologies). This creates redundant but slightly different discussions of these controls in multiple sections of the document, which is confusing. Also, the EMNR discussion on fish consumption advisories differs from the dredging discussion of the same types of advisories. The EMNR section specifically mentions attainment of RAO 2, while the dredging discussion does not. Again, one overarching and consistent statement on fish consumption advisories would

be less confusing. This comment also applies to the Swan Island Lagoon discussion on page 3-29 and MNR discussion on page 3-31.

114. Page 3-28 states, "Analysis of data collected during RI indicates that MNR is not occurring in Swan Island Lagoon at a rate sufficient to reduce risks within an acceptable time frame. There is limited water circulation within Swan Island Lagoon, limiting the rate of sediment deposition." While the LWG agrees with the conclusion about natural recovery in Swan Island Lagoon (SIL), no data presentation is provided that supports this contention. The text reverts instead to citing the RI, which does not present any clear information supporting this conclusion. The most direct support for this conclusion comes from the 2012 draft FS conceptual site model (CSM), MNR lines of evidence, and associated QEAFATE modeling. (Although it should be noted that the 2014 PCB sediment data in SIL suggest that some recovery of PCBs may be occurring in this area.) This highlights a critical gap in EPA's FS, which is the lack of any credible CSM and the lack of any detailed analysis of the natural recovery lines of evidence that support this conclusion. Incidentally, per the LWG's Section 2 comments, the limited Site information in EPA's FS Sections 1 and 2 does not constitute an adequate CSM.

115. Page 3-29 states, "All other areas of the site that exceed PRGs and have not been assigned a treatment technology will be addressed using natural recovery processes." This statement is unclear. Should the word "treatment" be replaced with "active remediation"?

116. Page 3-30 states, "The typical bathymetric survey measurement error range is 0.5 feet, resulting in an uncertainty range of 1 foot for bed elevation changes between the two surveys. The uncertainty range in a single direction would be 6 inches, which equates to roughly 1 inch (2.5 cm) per year for the period between the May 2003 and January 2009 surveys. Therefore, a minimum deposition rate of 2.5 cm/year was assumed." This analysis and the associated uncertainty range assessment are technically incorrect per SI comment 8c. Also, it is unclear how the assumption in the last sentence is used in the overall MNR analysis (i.e., the text does not indicate where this assumption is used or any relevant conclusions derived from this assumption).

117. Page 3-30 states, "Monitoring is an integral component of EMNR, and will be conducted to evaluate the long-term effectiveness." This section is about MNR, so "EMNR" in this sentence appears to be a typographical error.

118. Page 3-30 indicates regarding MNR monitoring, "The monitoring program will include sediment, surface water, pore water, and fish tissue samples collected at the following frequencies." Per comments 72 and 112, fish tissue and surface water sample monitoring should not be designated for specific remedial technologies like MNR. For reasons stated in those comments, these types of monitoring should be discussed as the overarching or Site-wide monitoring that will be used to track the overall progress of the sediment remedy toward achieving the RAOs, including all the component technologies that are applied under any given remedy. In addition, similar to the comment on EMNR, the purpose of porewater monitoring to track MNR is unclear.

Given there is a relationship between porewater and bulk surface sediment data as shown in the RI, and the RI and FS alternatives are mostly informed by sediment data (not porewater data), future Site-wide remedy performance monitoring should focus on sediment data (with tissue data providing a supporting line of evidence). If it appears that recovery is not taking place in sediment and tissue data at the expected pace, then additional monitoring could be conducted that is specifically targeted to determining why that might be the case. In some situations, this might include collection of porewater data related to specific contaminants where the partitioning between porewater and sediment appears to play a potential role in the pace of natural recovery. In contrast, indiscriminate collection of pore water samples will not assist in the evaluation on natural recovery.

119. Page 3-31 states, "Seven remedial alternatives were developed, including the no action alternative, based on the technology assignment assumptions presented in Sections 3.2 through 3.6. Consistent with EPA guidance (EPA 2005), a combination of remedial technologies and process options have been assembled into each alternative to account for variability in conditions throughout the Site." Because this text appears in Section 3.6, this is a typographical error that should refer to Sections 3.2 through 3.5. Also, this text implies that different technologies are compared among the alternatives, which is not the case. All alternatives are identical and only vary with respect to the area over which the actions are applied based on RALs. Per SI comment 1 this approach is inconsistent with guidance.

120. Page 3-31 states, "Consistent with EPA guidance (EPA 2005), a combination of remedial technologies and process options have been assembled into each alternative to account for variability in conditions throughout the Site." Per SI comment 1, this is not consistent with guidance given that there is no comparison between different technologies applied to the same area of sediments.

121. Page 3-31 states, "All the alternatives, with the exception of Alternative A, would accommodate continued use of the navigation channel." The rationale for this statement is unclear. Under the no action alternative, maintenance dredging would still presumably take place to the degree necessary to support continued navigation. No action in a CERCLA context means the absence of remedial action, not the absence of maintenance dredging and other normal river activities.

122. Page 3-31 states, "There are six distinct areas that will be addressed in each of the alternatives; the navigation channel (1,300 total acres), future maintenance dredge areas (241 total acres; 92 acres in Swan Island Lagoon and 149 acres in the main channel), intermediate areas (729 total acres), shallow areas (180 total acres), Swan Island Lagoon (113 acres), and river banks (26,141 total lineal feet)." These areas total to 2,580 acres. In Tables 3.6-1 and 3.7-2, the summation of the areas of remediation (including MNR which includes the remainder of the site not covered by other remedial technologies) totals to 2,450 acres. As indicated in SI comment 19d, EPA previously agreed prior to the revised FS that the Site was approximately 2,200 acres. The reasons for these inconsistencies are unclear.

123. Page 3-32 states, “Flowcharts of the technology assignment process are presented on Figures 3.6-1(a-c). The primary differences between the alternatives is the size of the footprint of removal and containment based on the area of the SMAs defined for each alternative, as shown on Figures 3.6-2(a-f) through 3.6-7(a-f). The area of each assigned technology is presented in detail in Table 3.6-1 and summarized in Table 3.6-2. Additional information on material volumes is provided in Tables 3.6-3 and 3.6-4.” Per SI comment 1, it is inappropriate for the only real difference in the alternatives to be the size of the footprint of removal and containment. Regarding the technology assignment Figures 3.6-1 series, see SI comment 1 for the LWG’s issues on this approach. Also, as noted in comment 52, the technology assignments in Figures 3.6-2 through 3.6-7 differ from those in Figure 3.3-27. Regardless of the correction of any errors in each map, the text does not explain how the two figures are related to the steps in the technology assignment scoring and decision tree process including the use of any “smoothing” steps. Further, the lists of technologies vary between the two figures with later figures having more differentiation of the technologies applied. In addition, the colors vary inconsistently between the two figures which makes cross comparisons difficult (e.g., capping is indicated with different colors on the two figures). Also, as requested by the LWG on September 8, 2015 (additional information requests) a figure is needed that shows the actual application of each and every technology identified in decision tree Figure 3.6-1 series to understand the results of the technology assignment process. A similar problem exists with Tables 3.6-1 and 3.6-2. The technology assignments types and numbers do not match the types and numbers of decision tree outcomes. For example, while the decision trees show outcomes for navigation/FMD, intermediate and shallow areas separately, Table 3.6-1 groups the dredging acreages for navigation/FMD and intermediate elevations, and provides no differentiation for capping areas across any of the elevation classifications. Similarly, in situ treatment, EMNR, and MNR acreages are undifferentiated across the elevation classifications. Also, the quantities for riverbank soils remediation provided in Table 3.6-4 are not understandable given that EPA does not define the riverbank remediation in typical cross section (schematically) or in terms of the specific riverbanks included in each alternative. Also, areas of organoclay mats are defined in Table 3.6-3, but the technology decision tree figures do not differentiate between PTW NAPL (which EPA indicated in the text would require organoclay if contained in place) versus high toxicity PTW. (The decision trees currently differentiate between PTW and PTW that is not reliably contained, which is not helpful in this case.) Consequently, there is no way to understand even conceptually where EPA decided to put organoclay mats for in situ containment of NAPL versus other types of reactive caps.

124. Page 3-32 text on the navigation channel states, “Contaminated sediment will be dredged to depth of the RAL concentrations (estimated as a maximum depth of 17 ft). If NAPL or PTW that is not reliably contained has been identified in a dredge area, a reactive residual layer is assumed. Otherwise, a residual layer is assumed.” Figure 3.6-1a indicates that depth of the RAL concentrations are “less than…15 feet” in the navigation channel, which is inconsistent with the text here indicating 17 feet. Also, the navigation area technology decision tree indicates a differentiation between

PTW and non-PTW and implies that reactive residual layers are needed for any form of PTW. However, the text here implies that only some forms of PTW require a reactive residual layer, and as a result, the methods that EPA actually applied are unclear. Also, per SI comment 2, it is unclear why EPA would assume that reactive residual layers are needed if the dredging is intended to remove the PTW. A simple residual calculation will show whether the remaining residuals would likely require such post dredge cover materials. This comment applies to wherever reactive residual layers are discussed. This comment also applies to text regarding “intermediate areas” later on page 3-32 and “shallow areas” on pages 3-32 and 3-33.

125. Page 3-32 text regarding FMD areas states, “Contaminated sediment will be dredged to depth of the RAL concentrations (estimated as a maximum depth of 19 ft).” Figure 3.6-1a inconsistently indicates that contamination is “less than 18 feet deep” in FMD areas.

126. Page 3-32 states, regarding technologies assigned in intermediate areas, “The maximum depth of contamination in this area is estimated to be 34 ft. Contaminated sediment will be dredged to the lesser of the RAL concentrations or 15 feet (assumed maximum depth since special design and side slope stabilization considerations would need to be conducted on an area-specific basis). If NAPL or PTW that is not reliably contained has been identified in a dredge area, then either an armored reactive cap or a reactive residual layer is assumed. Otherwise, a residual layer is assumed.” See comment 124 about the residuals methods. Also, per SI comment 19, the decision tree is inconsistent with the last sentence here because the decision tree indicates that the residual layer might also be a reactive residual layer if the area in question is in a groundwater plume.

    a. Also, the assumption of a reactive layer in groundwater plume areas does not address the range of potential issues that may exist in such groundwater areas. For example, why would a reactive residual layer be expected to isolate or reduce a groundwater plume of concern? In some cases a reactive residual layer might assist in this regard, but in other cases it may be ineffective. Also, the groundwater plume may be controlled by upland source control activities, and a reactive layer would provide no additional protectiveness. See SI comments 19o and 2b regarding appropriate FS level evaluations of groundwater plumes.

    b. Also, this text is notable because it contains no description of any of the other technologies evaluated and assigned in intermediate areas as depicted on Figure 3.6-1c (including reactive armored caps, armored caps, engineered caps, in situ treatment, EMNR, and variations of dredging to depth of contamination versus 15 feet). It is unclear why only one of the technologies is described, given there are presumably many “common elements” to these other approaches. The rationale behind all of the technology assignments in the decision trees need to be described for the approach to be understandable and reproducible.

127. Page 3-32 describes some (e.g., EMNR, but not all, of the technology assignment approaches for the shallow area. The text states, "Contaminated sediment will be dredged to the lesser of the RAL concentrations or a maximum depth of 5 feet, and the dredged material will be replaced with an engineered cap to previous elevation. Otherwise, the contaminated sediment will be dredged 3 feet and replaced with an engineered cap." Per comments above, the technology scoring matrix is not used for the shallow area assignments for reasons that are unexplained. The last sentence here is unclear because no options are provided in the previous sentence. Further, the shallow decision tree (Figure 3.6-1b) does not identify any areas that are dredged to 5 feet, the tree only defines areas that are dredged to 3 feet, the depth of contamination, or 15 feet. Thus, EPA's actual methods are unclear. (This comment also applies to text regarding 5-foot dredge depth at the top of page 3-33). Also, the text is inconsistent with the decision tree by indicating that an engineered cap is placed after dredging given that in groundwater plume areas a reactive cap is specified in the decision trees. Again, EPA's actual methods are unclear. See comment 126 and SI comments 19o and 2b regarding appropriate evaluations of groundwater plumes.

128. Page 3-32 states, "The dredge prism is assumed to be replaced with a reactive residual layer, filled with sand to within 6 inches of the original elevation and the last 6 inches will be beach mix. If NAPL or PTW that is not reliably contained extends to depths greater than 15 ft, a reactive cap is assumed to be placed at the bottom of the dredge prism, the remainder of the dredge prism will be replaced with sand to within 1 ft of the previous elevation and the last 1 ft will be beach mix." As described in SI comments 1 and 7, returning specific areas to their original elevation is not needed to better addresses habitat or other concerns. Particularly, in areas of deeper removal, 15 feet of backfill adds considerable expense to the alternatives with no clear benefit. Also, EPA does not consider that the beach mix will is unlikely to be stable in shallow wave action areas, and thus, this is an assumption that is not predictive of eventual remedial designs.

129. Page 3-33 states, regarding riverbanks, "If NAPL or PTW that is not reliably contained is present, a reactive armored cap is assumed." No other text or figures on riverbank remediation decisions is provided as part of the "common elements" discussion. Presumably, EPA made other decisions for riverbank areas that did not meet these PTW definitions. Consequently, the riverbank approach is almost completely undescribed and is not understandable to the reader. Also, it is unclear how EPA applied NAPL and PTW decisions to the riverbanks. None of the maps provided indicate where and to what extent EPA identified NAPL or PTW of any type in the riverbanks soils, and EPA does not describe what riverbank data or observations were used to make these decisions.

130. Page 3-33 states, "Removed material that is considered for treatment is assumed to be treated at a nearshore upland facility that will be sited and constructed in remedial design." However, the cost appendix inconsistently appears to assume that material will be treated at a distant facility near a Subtitle C landfill. Also, it is unclear whether EPA's costs related to the transload facility are intended to include an on-site treatment

facility or not. Regardless, the transload facility costs appear to be generally underestimated per SI comment 16.

131. Page 3-33 states, "DMM Scenario 1: Confined Disposal Facility and Off-site Disposal. This scenario is only applied to Alternatives E through G because the estimated dredge volumes under these alternatives are adequate for placement in the CDF because they will not meet the 1,005,000 cubic yards of sediment threshold to justify construction of a CDF. DMM Scenario 2: Off-Site Disposal. This scenario is applied to all alternatives." This text is unclear. Is EPA indicating that for Alternatives E through G that two sets of disposal and cost scenarios were considered (i.e., the first scenario assuming that some material goes upland and some goes to an on-site CDF and the second scenario assuming that all material goes to the uplands)? It appears based on text in Section 4.37.2 that EPA produced two separate cost estimates for these scenarios for Alternatives E through G. This could be explained more clearly in Section 3.

132. Page 3-33 states, regarding institutional controls in the "common elements" section, "Fish consumption advisories would be implemented after construction until PRGs are met. All caps will require waterway use or regulated navigation restrictions, and land use or access restrictions, long-term monitoring and O&M [operations and maintenance]." This text is different than the institutional control text presented under each of the remedial technologies. For clarity, general institutional controls, like fish advisories, should be discussed as a common element to all technologies (rather than inconsistently under each technology). Similarly, institutional controls that are specific to a particular technology (e.g., Registered Navigation Areas [RNAs] related to caps) should be discussed under that specific technology and not as a common element to all technologies.

133. Page 3-33 states for Alternative B, "This alternative involves dredging 81 acres to varying depths (614,130 to 818,830 cy [cubic yards]), ex-situ treatment of 240,840 to 321,120 cy, capping 21 acres, EMNR of 103 acres, in-situ treatment of 7 acres, and MNR of 2,250 acres." As noted in SI comment 19, these quantities are inconsistent with quantities in other places in the text including, but possibly not limited to:

   a. Table 3.3-6 indicates dredging of 59 acres, capping of 23 acres, cap/EMNR of 4 acres, and does not provide acreages for the other technologies.

   b. Table 3.6-1 indicates capping of 9.2 acres and identifies some dredge/cap areas, which are not presented in the text.

   c. Table 3.6-2 indicates 9 acres of capping.

   d. Table 3.6-2 indicates the total constructed area as 200 acres, and based on summing the text entries, the text indicates 212 acres.

   e. Also, as noted previously the total site acreages are in excess of the 2,200 total acres previously established for the project with no explanation.

This comment also applies to the other alternatives, although the specific inconsistencies may vary.

134. Page 3-34 states, "In-river construction duration for this alternative is estimated to be 4 years, with no additional time required to complete dredged material processing (i.e., dewatering and sampling for disposal parameters). The following alternative specific schedule dates have been estimated: Year 1: Establish initial conditions; Year1: Construction of on-site material handling/treatment facility; Year 2: Start construction of remedial alternative; Year 3: Dredging activities end; Year 4: Placement of final material ends." It is inappropriate to exclude "dredge material processing" from the construction durations. This generally results in an underestimate of the overall construction time. Also, the two elements defined as "processing" do not appear to include the full suite of activities that occur after dredging, which include transloading material to the upland, dewatering the sediments, sampling of material for disposal requirements, treatment of dewater, stockpiling of material at the transload facility, conduct of ex situ treatment and the internal steps to that process, transfer of stockpiled treated or untreated materials for transport (e.g., trucks) to the disposal facilities, transport to the disposal facilities, and placement of the material at the disposal facilities. Also, the overall timeline presented does not clearly include time needed at the dredge site for mobilization/ demobilization and installation and removal of water quality BMPs such as silt curtains and particularly sheetpiles. Also, it is unclear whether one year is sufficient to locate, purchase, and build the very large transload, ex situ treatment, and water treatment facilities needed to avoid process bottlenecks (see SI comment 5). Also, although EPA has provided some information on production rates for dredging in Years 2 and 3, no information on assumed production rates are provided for "placement of material." As a result, it is unclear whether one year is sufficient for the volume of materials and other construction (e.g., for engineered caps) that may be required. This comment applies to the construction schedules presented for all the alternatives, although specific inconsistencies and omissions may vary.

135. Pages 3-34 through 3-35 present the quantities for Alternative B broken down by navigation channel, FMD, intermediate, shallow, and riverbank areas. When totaled across these areas, there are numerous inconsistencies in the quantities presented as compared to the total quantities provided in the text and supporting tables (which are also often inconsistent with each other as noted in comment 133). These inconsistencies within Alternative B include:

   a. Total constructed acres in opening text is 212 acres and the sum of the areas presented is only 108 acres

   b. Total ex situ treatment volume in opening text is 240,840 to 321,120 cy and the sum of volumes presented in the areas is 514,000 to 685,590 cy.

   c. Total capping acres in the opening text is 21 and the sum of areas presented is only 10 acres.

d. Total EMNR acres in the opening text is103 acres and the sum of the areas presented is only 10 acres.

e. Within the FMD text, a total of 14.1 acres of dredging is identified, but the sums of individual post dredge residual cover placement acreages within the FMDs equals 14.4 acres.

f. Within the intermediate area text, a total of 23 dredge acres is identified, but the sums of individual post dredge residual cover placement acreages within the intermediate area equals 22.1 acres.

g. Within the shallow area text, a total of 13.5 dredge acres is identified, but the sums of the individual post dredge cover/cap placement acreages within the shallow area equals 14.8 acres.

EPA noted orally in an August 13, 2015 call that Section 3 quantity inconsistencies will not impact the overall FS within the guidance prescribed +50 to -30% cost accuracy. Given that some of these individual inconsistencies are around 100% (e.g., total constructed acres differences and ex situ treatment differences) it appears very possible that the overall costs do not meet the prescribed cost accuracy, particularly when these issues are taken together. This comment applies to all alternatives, although the specific inconsistencies may vary between alternatives.

136. Page 3-35 states, “In this alternative, 9,624 lineal feet of riverbank are assumed to be laid back to a slope of 5H:1V and covered with either an armored cap or an engineered cap using beach mix or vegetation. The volume to be excavated is estimated at 52,760 cy.” As noted above, the location of these assumed lineal feet is not presented, the slope lay back is inconsistent with the 1.7H:1V assumption presented earlier in Section 3, and the areas of cap, beach mix, or vegetation are not presented in any map or other figure demonstrating the conceptual approach. For example, the volume excavated would equate to a swath of riverbank 50 feet wide (over the specified lineal feet) and excavated to a depth of 3 feet. This does not appear consistent with a 5H:1V layback given many of the slopes are considerably steeper than this and would require deep excavation along the upland limit of the shoreline (potentially impacting upland structures and businesses), or alternatively, filling large amounts out into the shallow and intermediate areas of the sediments. Regardless, the methods are not understandable or reproducible. This comment applies to all alternatives.

137. Page 3-35 states for riverbank areas in Alternative B, “The estimated area to be capped is 10 acres: 3 acres with a reactive armored cap, and 7 acres with a reactive cap.” Again, there is no map or more detailed table indicating where these caps were assumed to be placed and how these acreages were derived. This comment applies to all alternatives.

138. Page 3-48 states, “Reductions in the site-wide SWAC were estimated by assuming the alternatives achieve an ideal constructed surface concentration of zero.” EPA has elsewhere indicated that the post remediation SWAC was estimated instead as 2.5% of the dredged concentration for dredge areas and zero for capping areas. The actual

methods used by EPA are unclear. Also, for a screening step, time-zero SWACs are a reasonable screening tool, but even for screening purposes, there should be at least a qualitative discussion of the expected variations in long-term effectiveness, if any.

139. Page 3-48 states, “Alternative B relies on less construction and more MNR to reduce risks and each alternative thereafter relies on more construction and less MNR.” It is unclear how this statement helps support conclusions about the relative effectiveness across the alternatives.

140. The references section is missing the following references cited in the Section 3 text:

a. USACE 2008

b. USACE 2008b

c. Louis Berge Group 2010

d. Integral and ARCADIS 2011

e. Anchor QEA 2011

141. Appendix E “Evaluation of Potential Water Quality Impacts from the Terminal 4 Confined Disposal Facility” was provided with Section 3 but is not cited anywhere in Section 3 text.

2 SECTION 4 COMMENTS

142. Page 4-1 states, “The evaluation of benthic risk was conducted on a point-by-point scale based on the empirical and predicted toxicity since these receptors are generally not mobile.” This is inconsistent with the text on page 4-2, which states, “0.2 RM was used for RAO 5 because spatial scales of ecological receptors ranged from a point to 1 RM.” Although both statements refer to point scale for benthic community risks, it appears EPA actually used a 0.2 RM scale for benthic risks. Also, per SI comment 17c, 0.2 RM is not consistent with the BERA assessment of benthic community risks. Also, as detailed in SI comment 17, the residual risk assessment in the FS was not conducted consistent with the BERA and, therefore, is technically incorrect. As described in subsequent comments, overall, the FS appears inconsistent regarding how EPA plans to handle individual points of benthic risk that lay outside the active remediation areas identified by the SMAs for each alternative.

143. Page 4-2 states, “Site-wide and smaller spatial scales were used to understand the effects of the alternatives in reaching the RAOs.” The methods description is unclear. EPA presents Site-wide time-zero SWACs at the beginning of each alternative discussion. However, the FS provides no residual risk information on a Site-wide spatial scale. The residual risk assessment appears to be EPA’s primary method of determining whether the alternatives might attain the RAOs. Regardless, the Site-wide spatial scale is appropriate for at least some SWAC and residual risk assessments

because some of the receptors and scenarios in the BLRAs were assessed on Site-wide spatial scales. See SI comment 17.

144. Page 4-2 states, “To conduct the smaller spatial scale evaluation, the site was first subdivided into nearshore areas, the navigation channel, and Swan Island Lagoon resulting in the following four river segments…This subdivision is preferred given the differing sediment dynamics and hydrodynamics of the shorelines and lagoon, current and future uses (such as navigation channel), and the preference of many receptors for shoreline habitat. Subdivisions will allow for a more precise analysis of risk reduction for each alternative.” Per SI comment 17, these spatial scales are not representative of any of the receptors or scenarios evaluated in the BLRAs, because none of the BLRA exposure assessments split the Site longitudinally in this manner. This configuration also does not match the aggregation of any of the background data. Consequently, the rationale for why this subdivision is “preferred” from a risk assessment consistency standpoint is unclear. Similarly, given the lack of consistency with the BLRAs, it is unclear how this approach makes the residual risk assessment evaluation more “precise.”

145. Page 4-2 states, “Since the exposure area of a mobile receptor, such as a fish or bird, is uncertain, several spatial scales were evaluated: 1) 0.2 RM was used for RAO 5 because spatial scales of ecological receptors ranged from a point to 1 RM, 2) 0.5 RM was used for RAO 1 (sediment only) for direct contact exposure of people engaged in fishing activities, and 3) 1 RM was used for RAOs 2 and 6 for the dietary exposure of humans and ecological receptors that consume fish and shellfish.” The text regarding RAO 1 spatial scale of 0.5 RM is inconsistent with Appendix H (residual risk assessment), which indicates a 1 RM spatial scale was used. A 0.5 RM (outside the navigation channel only) would be the appropriate spatial scale for consistency with the BHHRA. Also, see SI comment 17 for additional inconsistencies between this approach and the BLRAs.

146. Page 4-2 states, “This corresponds to the approximately estimated 1 mile exposure area over which recreational fishing and the home range of species such as smallmouth bass, hooded merganser, osprey, bald eagle and mink.” Where the noted scenarios and receptors were for 1 river mile, they were not necessarily split longitudinally in this manner in the BLRAs.

147. Page 4-2 states, “Additional SDUs were defined to address areas where multiple contaminants and/or benthic risk were identified at elevated concentrations between RM 4 and 6.” Given that the RALs evaluation in Section 3 does not consider benthic risk, and the evaluation of residual benthic risk in Section 4 indicates that all alternatives do not address a “substantial” portion of the benthic risks, it is unclear how the SDUs considered benthic risk.

148. Figures 4.1-1a through 4.1-1ac show graphs of the SDU analysis. See general disagreements with EPA’s use of spatial scales for such analyses in SI comments 17 and 19. Beyond the general disagreements, the LWG also notes the following:

a. The purpose of the SDUs and the actual methods for defining the SDUs (blue boxes) are not explained and the LWG cannot necessarily agree with the results. The SDUs are the same across all chemicals, but many of the chemicals are not elevated in a particular SDU. For example, on the top panel on Figure c, there appears to be no peaks in the rolling river mile averages (red line) for DDx for all of the SDUs identified from RM 2 through 7. Consequently, the overall method used by EPA to identify SDUs across all these graphs is unclear.

b. Results appear to be mostly non-detects (where EPA assumes half the detection limit) in some cases, which appears to make the SDU conclusions questionable. For example, see the top two panels of Figure d.

c. The SDUs in Swan Island Lagoon appear to be entirely driven by the presence versus absence of data, which makes the SDU process unclear for this area.

d. The presentation of BaPEq concentrations in the navigation channel is inconsistent with the risk assessments, given there are no BaPEq risks or PRGs that are related to navigation channel exposures (see SI comment 3 for more details).

e. The rolling river mile averages (red lines) appear mostly driven by high non-detects for some chemicals (e.g., aldrin, dieldrin, hexachlorobenzene in the navigation channel on Figures o, p, and ac), which makes these graphs irrelevant to the analysis.

149. Figure 4.1-2 and Table 4.1-1 show the locations of the SDUs and “key COCs” associated with each. Given that the methods for defining each SDU across all chemicals is not explained (per comment 148), EPA’s selection of “key COCs” is not understandable.

150. Page 4-2 states, “The effectiveness of each remedial alternative is evaluated in part by comparing the alternative’s post construction SWAC and the PRGs for each RAO in the SDUs.” It would be helpful for EPA to indicate where in the FS this evaluation is presented. Also, how is EPA evaluating the risk reduction associated with active remedies outside the SDUs, or even the necessity for active remediation in these areas?

151. Page 4-3 states, “EPA commissioned external expert reviews of this model (Jay 2012, Hayter ??), which identified several shortcomings that limit its usefulness in predicting sediment transport within Portland Harbor.” Because full references are not provided, it is unclear whether EPA has previously provided these references to the LWG for review. To the best of our knowledge, the LWG has not had an opportunity to review these documents, and therefore, the LWG cannot necessarily agree with statements supported by these references.

152. Page 4-3 states, “The HST model used models for channel flow (EFDC) and channel sediment transport (SEDZLJ). However, these modules were not coupled, such that changes in bed elevation due to deposition and erosion predicted by the SEDZLJ

module are not coupled back into the EFDC module in each time step." EPA commented to the LWG during FS technical discussions that lack of geomorphic feedback between the hydrodynamic and sediment transport models was a fatal flaw of the LWG Hydrodynamic and Sediment Transport (HST) model. The LWG conducted additional modeling using an approximate feedback mechanism and sensitivity analysis and submitted that information to EPA. The analysis demonstrated that including the effects of geomorphic feedback in the HST model had a minor impact on model predictions and did not change any conclusions about sediment transport and chemical fate at the Site. EPA never replied to the submitted information, and EPA's FS text does not address these additional analyses.

153. Page 4-3 states, "The calibration of the model rests entirely on attempts to reproduce observed difference between the 2003 and 2009 bathymetry, a time period without a major flood. There was no calibration of the model to predict sediment concentrations accurately." No model could have calibrated to a major flood because a major flood did not occur during the RI/FS. Consequently, EPA's issue here is with modeling in general, not anything specific to this model. EPA (2005) guidance is clear that "these models may have significant uncertainty, but may be useful for predicting whether or not there are significant differences between times to achieve protection using different alternatives." EPA's alternative approach is to make no long-term estimates at all, which is inappropriate. See SI comment 13 for more details. In addition, the statement about calibration is false. Appendix Ha, Section 3.3 presents the QEAFATE model chemical calibration in detail.

154. Page 4-3 states, "While the physical CSM emphasizes the importance of bedload transport indicating that about half the sediment load into the site occurs from bedload transport, the HST model does not include this transport process." EPA does not present or cite any known CSM that supports this statement. The LWG has commented previously on Sections 1 and 2 that the FS lacks a clear and detailed CSM presentation, which is critical to an adequate FS. Consequently, this is an unsupported and inaccurate statement about bedload. EPA agreed to not include bedload transport in any Site HST modeling well prior to when work on the 2012 draft FS started. (Records of communications can be provided, if desired.) EPA agreed a second time to the HST framework (i.e., the model using EFDC and SEDZLJ) that appeared in the 2012 draft FS, at least for draft FS purposes. It is unclear when EPA decided that this prior direction was a major issue for the model, and why EPA did not raise this concern earlier in the FS process. The LWG has reviewed this issue extensively in the past and determined it does not cause any major accuracy issues for the model.

155. Page 4-3 contains some additional criticisms of the HST model regarding tidal and circulation pattern issues. These remaining issues do not significantly affect the predictive capability of the model. If EPA had provided input to the LWG regarding these potential concerns, the LWG could have demonstrated the relative insignificance of these issues prior to completion of the FS. The LWG can still demonstrate the insignificance of these issues, if desired.

156. Page 4-3 states, "EPA also compared the results of the HST model to the 2003-2009 bathymetry data. A statistical analysis using simple regression was conducted to determine the predictability of the HST model. The methodology is presented in Appendix F and results are presented on Figure 4.1-3. Each graph on this figure represent an SDU and each dot is an HST grid cell. The results indicate that there is no correlation between the HST model predictions and the bathymetric change between 2003 and 2009 and that the model bias is always positive (more deposition is predicted than was actually measured)." EPA's model-data comparisons of bathymetry changes were conducted at the smallest spatial scale represented by the model (i.e., grid cell spatial scale). As with all numerical models, uncertainty in model predictions increases as spatial scale decreases, with the largest uncertainty occurring at the grid cell spatial scale. EPA did not use the available model-data comparisons at larger spatial scales from Appendix La of the 2012 draft FS (and presented to EPA as early as 2009), which are generally more relevant for evaluating remedial alternatives than the grid cell spatial scale (as discussed in the Appendix La). Thus, EPA's conclusions here are not based on a full and appropriate comparison of the model to the bathymetry data. EPA's statement that the model bias is always positive, with the model over predicting deposition are inconsistent with the results shown on EPA's Figure 4.1-3. Based on a cursory review, the model-data comparisons on this figure do not appear to be consistent with the model-data comparisons presented in draft FS Appendix La, suggesting some additional errors exist. A closer examination of Figure 4.1-3 and comparison to the draft FS model results would need to be conducted to determine if additional errors exist in EPA's analysis. Also, it appears that EPA did not account for areas that have been dredged for navigational or remediation purposes in this analysis.

157. Page 4-3 states, "EPA attempted to conduct an MNR analysis using the Sed CAM model, but encountered many of same issues identified in the evaluation of the accuracy and predictability of the HST model." As discussed in the SI cover letter, recovery curves generated by EPA's SEDCAM model show a general trend of natural recovery within a reasonable timeframe similar to the LWG's QEAFATE model. The outputs by two independent models, which correlate with the empirical data, would reduce the uncertainty associated with the QEAFATE model rather than support EPA's conclusion that all models are too unreliable for the purposes of the FS.

158. Page 4-3 states, "EPA has concluded that the HST model predictions are inconsistent with the CSM for this site, as it shows significant concentration reductions occurring within the first 10 years. However, given that the majority of the contamination was released into the river 30-80 years ago and similar reductions have not been observed, the model results appear inconsistent with the empirical data collected during the RI." Regarding the first sentence, see comment 154 regarding the lack of any clear and detailed CSM in the FS, which indicates that EPA has no basis for this conclusion. Regarding the second sentence, EPA presents no data to support the statement that similar reductions have not occurred in the past. For example, the surface to subsurface core ratio that EPA presents (and are also presented in more detail in the 2012 draft FS) clearly show that historical concentrations represented by subsurface sediments have generally higher concentrations than surface sediments that represent

more recent conditions. This evidence is directly contrary to EPA's conclusion here. Also, there is a logical error in this statement given that substantial sources were uncontrolled through the vast majority of the time period noted and until relatively recently. Consistent with EPA guidance on MNR (e.g., EPA 2005), source control is a necessary component to natural recovery, and the current rates of natural recovery would not be a logical expectation while sources were still uncontrolled.

159. Section 4.1.3 "Evidence for Natural Recovery"**—**The relationship between this section and Section 3.5.1 "Monitored Natural Recovery" is unclear, because neither section references the other or explains why natural recovery evidence is being discussed at this particular point in the text. These sections contain inconsistent information regarding the existence and rate of natural recovery at the Site, which is confusing. Also, see SI comment 8 regarding technical and presentation issues associated with these discussions.

160. Page 4-5 states, "Another challenge with using bathymetric surveys to indicate deposition rates is the incomplete coverage in shallow areas because it is difficult for survey boats to maneuver and obtain quality data. It is also the case that many of the areas of interest are also shallow. Not surprisingly, the entirety of the 6-Nav SDU is included, but, for example, 55% of 5.5W is included. The lack of information in these areas of interest lessens the ability to determine whether natural recovery is occurring." This discussion overemphasizes bathymetry coverage as a concern, and implies that these data are unusual in some respect. The bathymetry data series covers the vast majority of the Site and the SMAs defined by EPA in Section 3. A simple overlay of the bathymetry coverage area with the Alternative G SMA map in Section 3 clearly demonstrates this. Also, the bathymetry data for this Site are typical of bathymetry data on any project, given that bathymetry survey vessels can never fully access very shallow areas. It is better to have the bathymetry data and use it appropriately, than to be dismissive of the entire data set because of previously understood and accepted limitations of the technique involved.

161. Page 4-4 contains a paragraph that starts, "Fish tissue concentrations that have been sampled over time to evaluate whether they can indicate natural recovery processes." This paragraph is technically inaccurate and misleading for reasons detailed in SI comment 8. Later in this paragraph, EPA acknowledges that PCB declines in fish tissue are likely partially due to source controls. This is an important part of the CSM (which EPA does not provide) that should be accounted for when setting cleanup levels and developing alternatives.

162. Page 4-6 states, "The protection of human health is assessed by comparing the PRGs for RAOs 1 (sediment only) and 2 to estimated contaminant concentrations in sediment at the completion of construction." The text about "sediment only" is unclear. Because EPA refers to "beaches" in the next paragraph, it appears EPA is drawing a distinction between sediment direct contact BHHRA scenarios and beach sediment BHHRA scenarios. Also, per previous comments and SI comments 13 and 14, the time-zero concentrations are not an appropriate measure of protectiveness of the alternatives over the long term.

163. Page 4-6 states, “To determine whether the tissue PRGs for RAO 2 are expected to be achieved, predicted concentrations in sediment at MNR Year 0 are used to estimate concentrations in fish and shellfish tissue. Where the estimated tissue concentrations exceed PRGs for RAO 2, then it will be assumed that a fish consumption advisory will be necessary to provide protection in the short- and/or long-term.” The LWG could not find any presentation in EPA’s FS of the fish and shellfish tissue concentrations noted here. Also, given that time-zero concentrations do not represent long-term outcomes, it is unclear how such results can be used to determine the need for long-term fish consumption advisories.

164. Page 4-6 states, “A qualitative assessment of protectiveness for RAOs 1 (beaches), 3 and 4 will be conducted, as there are no current means to quantitatively assess the effectiveness of the remedial activities on overall concentrations in beaches, surface water, and pore water. The assessment will be conducted at the same time frames as for RAOs 1 and 2.” It appears that beach exposures or risks are never mentioned again in the FS. Surface water and groundwater (or porewater) exposures or risks are only mentioned in short unsupported statements later in the text. Also, the LWG disagrees that methods do not exist to evaluate surface water and beach exposures as discussed in SI comments 13 and 14. This comment also applies to the subsequent discussion of the evaluation of “Environment” RAOs. In addition, EPA indicates there is no method to quantitatively evaluate attainment of the riverbank RAO. Given the information presented in EPA’s FS, the LWG agrees with this statement, but riverbanks should be included in the assessment for reasons described in SI comment 4.

165. Page 4-6 states, “Alternatives are assessed as to whether they meet applicable or relevant and appropriate federal and state requirements (ARARs) (see Section 2.1) unless such ARARs are waived under CERCLA Section 121(d)(4).” Given that some surface water quality ARAR-based criteria are not met in upstream concentrations and surface water RAOs will not be explicitly met within the Site, the LWG believes more discussion of the relevance of waivers to the Site remedy process is warranted in the FS. Waivers are not mentioned in the evaluation of each alternative or the comparative evaluation of alternatives. The potential need for such waivers should be discussed in the evaluation of alternatives.

166. Page 4-7 states, “While some residual risk figures are presented in this section, all the residual risk figures are provided in Appendix H.” Appendix H contains a description of rolling river mile SWAC estimates but not any additional residual risk figures.

167. Page 4-7 states, “The process of evaluating estimated future risks uses the methodology and assumptions, presented in the baseline risk assessment.” Per SI comment 17, this statement is false. For example, the risks presented for the No Action alternative (Alternative A) differ substantially from those presented in both the BHHRA and BERA. The no action alternative should have “time-zero” concentrations that are identical to the baseline concentrations used in the BLRAs, given that no action to alter those baseline concentrations is taken under this alternative. Instances of these discrepancies are noted in SI comments 17 and 19, but all such discrepancies have not yet been identified by the LWG. In all cases so far identified, the Hazard Quotients

(HQs) or cancer risks identified in the FS for the no action alternative are higher than those presented in the BLRAs. This creates a concern that both the no action and residual risks for the other alternatives are being substantially overstated throughout the FS and are inconsistent with the BLRAs. This comment also applies to the subsequent paragraph on “Ecological” residual risk.

168. Page 4-7 states, “For purposes of comparing relative reductions in risks, carcinogenic risks and non-carcinogenic health hazards are estimated for the most protective RME scenarios only.” This is an inappropriate evaluation of residual risks, because it is generally inconsistent with the range of risks presented in the BLRAs. This comment also applies to the subsequent paragraph on “Ecological” residual risk.

169. Page 4-7 states, “Arsenic, mercury, BEHP, PDBEs, and pentachlorophenol are not included in the evaluation of future risks via consumption of fish because no relationship has been established between concentrations in sediment and predicted concentrations in fish tissue.” This is also true for cPAHs (or BaPEq), and yet EPA presents RAO 2 (fish consumption) residual risk evaluations for this chemical class. It appears these evaluations are based on a shellfish PRG, which is not relevant to fish consumption risks as the LWG indicated in Section 2 comments. It appears that EPA is being inconsistently selective on when to apply this decision.

170. Page 4-7 states, “Exposure point concentrations (EPCs) for post-remedial exposures are based on modeled estimates of contaminant concentrations in sediment, representing the range of predicted concentrations at the completion of construction.” Given that prior text indicates no models are used in these assessments, it is unclear what model is being referred to here.

171. Page 4-7 states, “Containment systems (caps and CDF) and institutional controls will be assessed to determine that contaminant exposures, including residuals, to human and ecological receptors are within acceptable levels.” This evaluation is also qualitative, which is not clearly identified in this text. Also, the inclusion of residuals in this evaluation is unclear. EPA does not appear to have discussed within this subcriterion for each alternative the impacts of dredge residuals, which generally are not “contained” by post dredge covers. Also, EPA does not identify any specific institutional controls or procedures that directly address potential concerns about uncontained residuals. For example, the actual Alternative B assessment on page 4-17 simply states, “Operation and maintenance activities, ICs [Institutional Controls] and monitoring will be implemented to enhance the adequacy and reliability of caps, residual management layers and EMNR. Caps would be monitored and maintained in perpetuity.”

172. Page 4-7 states, “Repairs, maintenance, and other activities conducted in perpetuity will be necessary for various caps and the on-site CDF, if constructed. Monitoring, including measurement of COC concentrations in sediment, water column, pore water, groundwater and biota is another long-term component of the remedial alternatives. Monitoring of caps will be conducted to ensure and document the integrity and effectiveness of the cap in isolating contaminants. Cap repairs are assumed to be

conducted as needed throughout O&M during a hundred year period." This discussion is very similar to the actual "assessments" presented in the alternatives evaluation subsections. Consequently, it is unclear that any additional evaluation beyond these statements was conducted. Also, it is unclear why dredge residuals are not addressed in this or subsequent monitoring discussion. Residuals are largely uncontained by post dredge covers and can cause ongoing short and long-term impacts, whereas caps are specifically designed to contain contaminants for long periods.

173. Page 4-7 states, "Upland source control measures designed to prevent the migration of contamination to the river will also need to be evaluated long-term; however, this FS assumes that all upland sources are adequately controlled and will not evaluate their effectiveness." The LWG agrees that EPA should make this assumption, but EPA has assumed elsewhere in the FS that riverbank soils are not addressed and require specific incorporation into the sediment remedy alternatives. Similarly, EPA makes numerous technology assignment and alternative develop decisions that assume that upland groundwater plumes are not controlled by upland source controls. Riverbank and groundwater sources should be handled the same as other upland sources.

174. Page 4-8 states, "The evaluation of short-term effectiveness includes the risks to workers and the community from transport of wastes and borrow materials, risks to workers on dredges or barges, measures to address those risks, numerical estimates to demonstrate that residuals can be successfully managed during dredging or capping activities, and BMPs to mitigate environmental impacts, such as emissions or noise." The reference to "numerical estimates" is unclear, and therefore, it is unclear that the FS demonstrates that such residuals can be successfully managed. Also, it appears biased that all the short-term effectiveness issues are assumed to be successfully managed or mitigated prior to the actual evaluation of the alternatives being presented. In contrast, EPA refuses to assume that concerns about the long-term reliability of caps can be successfully managed, even though the 25 year history on sediment remediation caps and EPA guidance (e.g., 2005) indicate this is true.

175. Page 4-8 states, "Relevant experience at other sites is used to support implementation timeframes for in-water technology assignment components. Additionally, quantitative dredge production calculations are performed based on Schroeder and Gustavson (2013). Capping implementation timeframes are based on a review of similar types of capping projects and not specifically calculated for this project." No citations of "other sites" or "similar types of capping projects" are provided, and as a result, the subsequent discussion of implementation time-frames is not well supported. Also, see SI comments 5 regarding the LWG concerns with the Schroeder and Gustavson memorandum. Also, there is no further discussion in the FS of how the capping information was used to calculate the timeframes presented in Section 3 regarding material placement construction activities.

176. Page 4-8 states, "Time to achieve RAOs and PRGs will be quantitatively evaluated at the completion of construction and qualitatively evaluated post construction (see discussion in Section 4.1.2 regarding limitations in the ability to evaluate this quantitatively). This evaluation will be conducted at varying spatial scales relevant to

the RAOs and within SDUs. While some rolling river mile figures are presented in this section, all the rolling river mile figures are provided in Appendix I." First, time-zero or post-construction estimates are the same metric that is used to evaluate long-term effectiveness. It is unclear how the same metric can be used for both short and long-term evaluations. Second, see previous comments regarding inconsistency with the risk assessment spatial scales in general. Third, regarding the Appendix I figures, it is impossible to distinguish between the alternatives on most figures over most river miles. A log scale y-axis would make the figures more interpretable. Overall, see SI comments 13 and 14 regarding the technical and guidance consistency issues with the short-term effectiveness methods.

177. Page 4-9 states, "Cost estimates are developed according to A Guide to Developing and Documenting Cost Estimates during the Feasibility Study (USEPA 2000). The levels of detail employed in making these estimates are conceptual but are considered appropriate for differentiating between alternatives. The cost estimates are based on the best available information regarding the anticipated scope of the respective remedial alternatives." EPA goes on to say in the next paragraph "Cost estimates are developed with expected accuracy ranges of -30 to +50 percent." It is unclear whether "conceptual" estimates are consistent with the cited guidance to attain the +50/-30% accuracy stated. The text indicates that EPA believes this is the case, but the FS should explain how it was determined that the prescribed accuracy was met. Also, it is unclear what "best available information" means. For example, the cost estimates are only as good as the underlying technology assignments, other assumptions, and resulting calculated quantities in Section 3, which have been shown to have numerous inconsistencies as described in previous comments. See SI comment 16 for details on items where it appears that best available information was not used or inappropriately used in the cost estimates.

178. Page 4-9 states, "Cost estimates are developed for each remedial action alternative based on the RI data to define the scope of each alternative." Generally, the sentence is unclear. Also, it is unclear why RI data, rather than the FS database mentioned in other places, is being used to define the scope of each alternative.

179. Page 4-9 states, "The types of costs estimated include the following: (1) Capital costs, including both direct and indirect costs (2) Annual operations and maintenance costs; and (3) Net present value of capital and O&M costs (40 CFR 300.430 (e)(9)(iii)(G))." It is unclear why the O&M columns in some of the Appendix G cost estimate tables and Table 4.3-1 are blank or contain $0. The reader should be directed to where these different types of estimates can be found.

180. Page 4-10 states, "To support the detail analysis and evaluation of remedial alternatives, a sensitivity analysis was also performed within the cost estimate for each alternative to determine those costs that have the greatest impact on the overall cost (see Appendix G)." The cost sensitivity analysis does not yield useful information about the actual range or accuracy of the cost estimates. For example, the correct way to use +50%/-30% prescribed accuracy range is to compare sensitivity analysis results against this range, which is the cost estimate performance "measuring stick." That is,

did the cost sensitivity analysis results fall inside or outside the +50%/-30% prescribed accuracy? Instead, EPA incorrectly multiplies the calculated costs by +50%/-30% to generate a range of costs for some of these evaluations. This incorrect method appears to misleadingly indicate that the costs are within the required range, but it provides no actual comparison of whether the costs estimates lie within the required level of accuracy.

181. Page 4-11 starts the evaluation of the alternatives against the seven CERCLA criteria evaluated in an FS. The LWG has numerous concerns about this evaluation as detailed throughout the SI comments and SI cover letter. Consequently, all the specific instances related to these general themes are too numerous to capture through individual comments on each sentence of the evaluation. Instead comments 181 and higher focus on more specific issues, specific errors or inconsistencies, or information that is particularly illustrative of the larger issues in the SI comments. Also, there are numerous residual risk estimates presented, which the LWG has not had time to independently compare for consistency with the BLRAs. However, per SI comments 17 and 19 many inconsistencies are known to exist, which creates a general concern that residual risks are over stated in almost all cases (see comment 167).

182. Page 4-11 states, "Direct contact carcinogenic risks are estimated to be less than 4×10^{-4} (Figure 4.2-1)." Neither the text nor the figures, explain how the "background risk" levels presented in the figure were determined. The LWG may not agree with these background estimates. This comment applies to all residual risk figures presenting "background risk" levels.

183. Figure 4.2-3a(1) and similar figures presenting non-cancer risk. The y-axis is unclear and just says "risk." It appears that HQs are being presented, but many of the results are well below a value of 1, in some cases even for the no action alternative, which is counter-intuitive.

184. Page 4-12 discusses compliance with numeric surface water and drinking water ARARs. Per SI comments 13 and 14, EPA makes no quantitative estimates of surface water concentrations for the alternatives. As a consequence, any statements about compliance with these numeric ARARs (such as at the bottom of page 4-12) are unsupported. Also, EPA does not discuss whether the ARARs are currently met or could ever be expected to be met given upstream concentrations of some chemicals are already above these numeric ARARs. Also, as discussed in the 2012 draft FS, the LWG drinking water Maximum Contaminant Level Goals (MCLGs) and Maximum Contaminant Levels (MCLs) are not an ARAR for untreated surface water at this Site. And as presented in the BHHRA, baseline risks do not exceed these drinking water criteria, with rare exceptions for a few chemicals. This fact should be made clear in EPA's FS.

185. Page 4-12 states, "Additionally, the state standards for the degree of cleanup required by remedial actions for both cancer and non-cancer risks would not be achieved." These findings are not clearly presented. Once the many issues with the residual risk assessment are addressed per above comments, the text should compare specific

residual risk outcomes for each alternative to the specific levels required in the Oregon law in order to demonstrate any statements such as this are true. Such a discussion would also need to note that these are only time-zero estimates, and conclusions about long-term compliance with these ARARs cannot be reached without EPA also adding some type of quantification of long-term effectiveness.

186. Page 4-13 regarding the no action alternatives states, “The presence of source material in the sediment would limit the ability for natural recovery processes to occur. Reductions in COC concentration and related risks are expected to occur over time, but the RAOs would not be achieved in a reasonable time frame. Residual risk would be greatest with this alternative.” This statement is unsupported. Both the QEAFATE and EPA’s SEDCAM modeling indicate that natural recovery will take place even for the no action alternative, but these models are not discussed. Thus, based on the information in EPA’s FS, it is not clear to what degree “source material” would limit natural recovery and to what extent RAOs would be achieved in a reasonable timeframe under the no action alternative.

187. Page 4-13 states, “Studies show that the existing advisories are not sufficiently effective in protecting human health since, despite their presence, some anglers still eat their catch and bring their catch home for their families to eat (May and Burger, 1996; Burger et al, 1999; Kirk-Pflugh et al, 1999 and 2011). In addition, consumption advisories are ineffective in reducing risk to ecological receptors.” The consumption advisories are not necessarily meant to prevent all fish consumption, but are focused on sensitive subpopulations. So, failure to prevent all consumption is not necessarily a failure of the advisory.

188. Page 4-14 states, regarding the no action alternative, “However, some PRGs are currently met in some areas of the site as noted below.” This raises the question of why these PRGs are needed in the first place or why they would be applied where baseline risks do not exist. If the no action alternative (i.e., baseline concentrations) already meets the PRG, then the PRG, or its application to a particular area, is inconsistent with the BLRAs. This comment applies to all similar statements regarding the no action alternative. Also, many of the PRGs and application of the PRGs are incorrect as discussed in SI comment 17.

189. Figures 4.2-7 through 4.2-10 contain horizontal lines labeled “Upstr SedTrap Median.” The calculation of these values or how they are relevant to the analysis is not discussed anywhere in the text. This appears to be some type of equilibrium or similar estimate. The LWG strongly encourages the EPA to expand upon the lines of evidence used in these types of comparisons and explain the rationale associated with the comparisons in much more detail in the FS. For example, even though these lines are plotted on the figures, there is no discussion in alternatives evaluation text regarding how this information helps inform alternative selection or the achievability of any of the RAOs or associated PRGs. This issue is directly relevant to the guidance on RAOs (EPA 2005), which states, “When developing RAOs, project managers should evaluate whether the RAO is achievable by remediation of the site or if it requires additional actions outside the control of the project manager.”

190. Comments from this point forward are based on text in the Alternative B evaluation section (4.2.2). To the extent that any other text, tables, or figures present similar information for the other alternatives, the comments on Alternative B also apply to these other alternatives.

191. Page 4-15 states for Alternative B, "Alternative B, in conjunction with MNR and institutional controls, is expected to be protective of human health. Alternative B would address the unacceptable risks to human health through capping, dredging, in-situ treatment and EMNR of 200 acres of contaminated sediments and 9,600 lineal feet of riverbank. The construction duration for this alternative is estimated to be 4 years, with no additional time required to complete dredged material processing." The total for constructed acres (200) noted here is inconsistent with the text in Section 3 (which indicates 212 acres). Also, per SI comment 13, it is unclear how EPA determines any of the alternatives are protective overall. Also, per comment 134, it is unclear how EPA determines that material processing will take no additional time.

192. Page 4-16 states, "Reduction in SWACs on a site-wide basis for Alternative B following construction as compared to Alternative A (does not consider MNR) for the focused COCs are as follows…" The LWG agrees that Site-wide SWACs are a good overall starting place with which to judge the alternatives, because they are relevant to several important exposure assessment spatial scales from the risk assessments (e.g., subsistence fisher scenario). However, per previous comments, the overall protectiveness and long-term effectiveness of the alternatives should not be evaluated using time-zero concentrations. See SI comment 13.

193. Page 4-16 states for Alternative B, "Concentrations of other COCs would also be reduced in surface sediment under this alternative." This is an unsupported statement. For example, the 2012 draft FS contained a large appendix that estimated the SWACs achieved for each alternative for every focused COC for every relevant spatial scale. No similar backup for this statement is provided in EPA's FS.

194. Page 4-16 states for Alternative B, "Further reductions in risk and hazards are expected through natural recovery processes (MNR) and implementation of institutional controls, although the timeframe for achieving RAOs is uncertain." The LWG agrees that based on information presented in the FS that the timeframe for achieving RAOs is highly uncertain. Consequently, EPA's later statements that the larger alternatives (e.g., Alternative D through G) would achieve the RAOs quicker than Alternative B are unsupported. An example of these unsupported statements is the text on page 3-37, which states, "Further risk reductions are likely to occur over time due to natural recovery processes, and the likelihood of achieving RAOs 5 and 6 within a reasonable timeframe are greater than for Alternative B." See SI comment 13 for more details on the uncertainties in time to achieve RAOs and how that impacts alternative evaluation conclusions.

195. Page 4-16 states for Alternative B, "There are a substantial number of locations where unacceptable benthic risk (identified via bioassays or predicted via the LRM [logistic regression model]) are not encompassed by the areas of construction as shown on

Figure 4.2-11." Per SI comment 15, the BERA is clear that individual and limited benthic toxicity lines of evidence shown in the cited figure are insufficient to fully characterize benthic risks at the Site. Therefore, EPA's methods are inconsistent with the BERA. Further, EPA is also inconsistently not using the EPA-proposed benthic toxicity PRGs from Section 2 for the benthic assessment in Section 4 for reasons that are not explained.

196. Page 4-17 states for Alternative B, "Because this alternative focuses on containing or removing the highest contaminant concentrations at the site through capping, dredging, in-situ treatment and EMNR it is expected that there will be substantial reductions in contaminant flux from the surface sediment to the surface water and subsequently surface water and fish tissue concentrations. However, these reductions may not be sufficient in a reasonable time frame." Per previous comments, the timeframe statement is unsupported. Also, although reductions in sediment to surface water flux would be expected with any active remediation, this provides no information with regards to whether surface water ARARs and acceptable risk levels in fish tissue would be achieved by any of the alternatives. This is particularly because some numeric ARAR water criteria are currently exceeded in surface water upstream of the Site.

197. Page 4-17 states for Alternative B, "Placement of reactive caps in locations of contaminated groundwater flux would reduce the exposure to those contaminants and assist in attainment of RAOs 4 and 8. However, the extent of the caps may not be sufficient under this alternative to deal with the extent of the groundwater plumes expressing in the sediment." Per Section 3 comments, application of only one technology (in this case reactive caps) across all alternatives does not provide any way to compare whether other technologies would better address groundwater flux issues relative to each of the FS evaluation criteria. In this case, is reactive capping better or worse than other options, like in situ treatment, standard caps, or different kinds of upland source controls? Also as noted in Section 3 comments, these statements do not consider whether upland groundwater plumes may already be controlled (e.g., the Gasco pump and treat system causes a reversal of groundwater seepage such that no additional remediation would be needed in the river solely to address groundwater plumes). Thus, the text statement that caps "may not be sufficient" appears to miss the larger point that the limited evaluation does not allow any meaningful conclusions regarding the effectiveness of any technologies for site-specific groundwater plume issues.

198. Page 4-17 states, "Alternative B has a greater likelihood of achieving RAO 9 than under Alternative A due to removal of contaminated riverbank materials and placement of either an armored or engineered cap using beach mix or vegetation. However, the extent excavation and capping under this alternative may not be sufficient to deal with the extent of the contamination in riverbank soils that may recontaminate the river sediments." This is the same general issue as the groundwater plume discussion in comment 197. That is, EPA makes no qualitative or quantitative estimates of ongoing riverbank soil erosion as a source to sediments and applies the same technology to the same stretch of riverbank in every alternative. Thus, there is no way to tell whether the assumed remedial technologies will be effective in reducing the unknown soil erosion,

and there is no way to compare the relative effectiveness of one technology to another. This is another reason that riverbanks and RAO 9 should not be included in the FS, per SI comment 4.

199. Page 4-17 states for Alternative B, “Resuspension/release during construction activities will be addressed through operational best management practices (BMPs) and engineered control measures.” The working assumption appears to be that resuspension and other dredge releases will be entirely controlled to adequate levels by the assumed BMPs and control measures. Thus, EPA’s FS appears to assume that there will be no unacceptable releases impacting short-term effectiveness. But there is no quantitative or qualitative analysis to support this, which is contrary to the guidance as detailed in SI comments 9 and 14.

200. Page 4-17 states, “Thus, for Alternative B the magnitude of the residual risks remaining are largest, and achieving final cleanup levels depends on the effectiveness of MNR and adherence to ICs.” This is only true to the extent that all the evaluations are based on time-zero concentrations. EPA’s FS information does not allow a comparison of actual long-term residual risk levels across the alternatives.

201. Page 4-18 states for Alternative B, “Implementation of the alternative in conjunction with adequate upland source control measures over time are not expected to cause or contribute to exceedances of numeric human health and aquatic life water quality criteria and drinking water MCLGs and MCLs. Oregon’s risk standards for degree of cleanup for hazardous substances will be met over time through implementation of remedial technologies, ICs, and monitoring.” See comments 184 and 185 about the applicability and achievability of these criteria. Also, it is unclear how EPA can determine that dredge releases or long-term surface water outcomes will not “contribute” to exceeding any of these criteria given that 1) upstream surface water already exceeds some of the lower human health and aquatic life criteria and 2) that EPA has conducted no quantitative analysis to support this statement.

202. Page 4-18 states for Alternative B, “Because this alternative relies more heavily on MNR to achieve PRGs and RAOs, the timeframe for compliance with chemical-specific ARARs for all COCs in surface water will be longer compared to other alternatives that rely more on capping and dredging to address contamination. Long-term monitoring and maintenance of engineering controls, pore water, and surface water would ensure that chemical specific ARARs are being met.” Per previous comments, EPA’s conclusions about time to achieve RAOs and long-term outcomes in general are unsupported due to the lack of relevant quantitative analysis as detailed in SI comments 13 and 14. For surface water, the conclusions are even more tenuous given that no quantitative estimates whatsoever are presented for surface water and upstream concentrations for some chemicals already exceed cited ARARs. For the same reason, no amount of monitoring and maintenance of engineering controls can “ensure” that these ARARs are being met.

203. Page 4-18 states for Alternative B, “During implementation of this alternative potential short-term exceedances of some water quality criteria are possible.” However, EPA

makes no quantitative estimates of these releases. Per comment 199, the guidance is clear that the FS should estimate site-specific short-term releases (particularly dredge releases). Per SI comments 9 and 14, EPA chose not to use any of the readily available quantitative tools from EPA and Army Corps guidance that estimate dredge releases.

204. Page 4-19 states for Alternative B, “Compliance with ESA would be met through preparation of a Site-wide Biological Assessment (BA). The BA will evaluate the effects to species listed as threatened or endangered under ESA found at the site and those species’ designated critical habitat from the proposed remedial activities and how such impacts will be mitigated and reduced.” It is unclear why EPA chose not to use any of the draft Programmatic BA submitted by the LWG with the 2012 draft FS, which was developed after extensive meetings and discussions with the National Marine Fisheries and U.S. Fish and Wildlife Services (Services). Consistent with that draft Programmatic BA, the 2012 draft FS also presented a detailed method for estimating habitat mitigation costs that were specific to each alternative. It is unclear why EPA chose not to use this method, which was developed in coordination with the Services, or something like it, in the FS.

205. Page 4-20 states for Alternative B regarding compliance with FEMA regulations, “Perform detailed modeling to demonstrate that the alternative does not result in unacceptable flood rise.” In general, the text surrounding this statement presents evaluations that will be conducted in the future for the selected alternative. None of these evaluations were conducted in EPA’s FS to help assess alternative performance relative to Federal Emergency Management Agency (FEMA) regulations. Given that EPA required the LWG to conduct HEC-RAS modeling of each of the 2012 draft FS alternatives, it is unclear why EPA did not conduct similar modeling for its FS alternatives, which would be consistent with EPA’s text here.

206. Page 4-22 states for Alternative B, “The alternative would meet all of the substantive requirements of this ARAR during design, construction, and long-term monitoring. Full compliance with CWA 404(b)(1) includes preparation of a 404(b)(1) evaluation document to determine the potential impacts of the activities performed under this alternative on waters and wetlands, as well as opportunities to mitigate any unavoidable adverse impacts to those aquatic resources…A compensatory mitigation framework will be developed which, in coordination with NMFS and USFWS, may use a Habitat Equivalency Analysis (HEA) method, Relative Habitat Value (RHV) scoring approach, or other approach for determining compensatory mitigation acreages.” EPA does not provide quantitative or detailed assessment to support the first statement. Such an assessment was provided to EPA when the LWG submitted a draft 404(b)(1) analysis in Appendix M of the 2012 draft FS. This analysis included a detailed compensatory mitigation framework that was developed in coordination with the Services that used a HEA and RHV methods as developed in coordination with the Services at that time. It is unclear why EPA chose not to use this analysis, even in part, for its FS. Again, instead of conducting an assessment, the text here discusses future requirements for the selected alternative during design and then states, on that basis, that the alternative will be compliant with the ARAR, a statement that is not supported.

207. Pages 4-22 and 4-23 state, "During dredging and cap placement operations, potential short-term exceedances of some water quality criteria are possible. However, through the application of BMPs and engineering control measures water quality criteria will be met in accordance with Section 401 and Oregon's Water Quality Law." This issue has not been adequately addressed by EPA's FS as described in comments 199 and 203.

208. Page 4-23 states, "The substantive requirements of the RCRA ARAR would be met during design and implementation of the alternative. Analytical testing results of dredged sediment will be used for waste characterization. Initially this will consist of evaluation of remedial investigation data which will then be supplemented with design-level information. The sediment and soil disposal decision tree (Figure 3.3-40) is used to guide the process to determine appropriate disposal." Per SI comment 18, dredged sediment should only be sampled for RCRA requirements in those cases where Site data or process knowledge indicate the dredged sediment may be a listed or characteristic waste. Also, per comments 103 and 104, this entire RCRA section is unclear regarding whether this information is consistent with the RCRA discussion in Section 3 and which (or both) discussion informs the actual development of alternatives. Also, the second to last sentence is unclear. Does the phrase "will consist of evaluation of remedial investigation data" refer to an evaluation conducted later in the FS or to something that will be conducted in design? Regarding Figure 3.3-40, see comment 106 for the LWG issues with this figure.

209. Page 4-23 - The remainder of this page describes information (including two tables and two figure sets) leading to the apparent determination of additional RCRA hazardous wastes beyond those identified as listed and characteristic using Site TCLP results in Section 3. This includes the text, "Waste will also be sampled as generated to determine any volumes that exceed Land Disposal Restrictions (LDRs) and will require the prescribed treatment prior to disposal. LDR values have been established for 39 COCs as shown in Table 4.2-11. The RI data set indicates that 32 COCs exceed the criteria. The locations where these criteria are exceeded is presented on Figures 4.2-13a-e." Again, it is unclear whether and to what extent the additional areas identified in this discussion and supporting figures were included in the development of any of the alternatives. For example, the cost appendix identifies no RCRA hazardous waste related costs that the LWG could find. It is also unclear why such a discussion would be first presented under an evaluation of Alternative B. Typically, by this point in the FS all the information necessary to evaluate the alternatives has already been presented and that information is used to evaluate the alternatives, not discuss general Site and potential waste features. Also, almost all aspects of this discussion are incorrect or inconsistent with the cited regulations as detailed in SI comment 18.

210. Page 4-24 states, "State-listed hazardous waste has been identified off the Arkema site." This determination is incorrect for reasons detailed in SI comment 18.

211. Page 4-24 states, "It is anticipated that TSCA waste containing greater than 50 mg/kg of PCBs may be generated as a result of remedial actions in riverbank areas." This is

an unsupported statement, because EPA presents none of the additional riverbank data purportedly used to inform the riverbank portions of the FS.

212. Page 4-24 states for Alternative B, "The substantive requirements of these ARARs would be met during design and implementation of the alternative. Reasonable precaution to control fugitive emission of air contaminants will be taken in accordance with OAR 340-226. Emission of airborne particulate matter would be controlled to address OAR 340-208. Dust suppression will be maintained to eliminate air contaminant migration during remedial action in compliance with these ARARs." As detailed in SI comment 13 and 14, EPA provides no supporting evaluation for these statements. In comparison, Appendix Ic of the 2012 draft FS contained detailed and quantitative estimates of air emissions for each alternative.

213. Page 4-25 states, "Under Alternative B, approximately 872,000 cy of contaminated sediments and riverbank soil covering approximately 76 acres of river bottom and 9,600 lineal feet of riverbank would be permanently removed by dredging or excavating to targeted sediment removal depths. Various caps would be placed over 34 acres of the site. Residuals from dredging and contaminated areas subject to EMNR would be managed with a thin layer sand cover at approximately 179 acres." The cubic yardage here is inconsistent with Table 3.7-2, which indicates Alternative B involves 614,130 to 818,830 cy. The dredging acreage is inconsistent with Section 3 text and tables (e.g., Table 3.7-2), which indicate 81 acres of dredging for Alternative B. The capping acreage is inconsistent with Table 3.7-2, which indicates 23 acres of capping for this alternative.

214. Page 4-25 states for Alternative B, "After construction is completed, the remediated areas would no longer pose unacceptable impacts to humans and the environment." This is inconsistent with the results of the time-zero concentrations presented in the FS, which indicate in some cases acceptable levels would not be reached after construction.

215. Page 4-25 states for Alternative B, "The time needed for MNR to achieve the RAOs is less than the time it would take natural recovery to achieve the same level of protectiveness for Alternative A. In addition, some of the areas where groundwater contamination is discharging to the river will be capped to eliminate or reduce this discharge, which in combination with lower overall contaminant concentrations in surface sediment will decrease the time needed to achieve RAOs 3, 4, 7, and 8. Contaminated material addressed in riverbanks under this alternative will also eliminate sources of contamination that will continue to recontaminate the site and decrease the time needed to achieve RAO 9." Per previous comments, the relative timeframes to meet RAOs across the alternatives cannot be determined based on the information included in the FS. Also, the impacts of groundwater discharge or riverbanks soil erosion under the alternatives have not been actually assessed or compared across various technologies that might be effectively applied. These are all unsupported statements.

216. Pages 4-25 and 4-26 summarize EPA's residual risk estimates under the long-term effectiveness subsection for Alternative B. Per comments on Section 4.2.2.1 (overall

protectiveness) starting on page 4-16, the methods and findings of the residual risk assessments are incorrect, including the benthic risk analysis. Also, it is unclear why EPA has very similar but slightly different summaries of the same residual risk assessment results under both the protectiveness and long-term effectiveness sections. One consolidated discussion in one place would be clearer and less confusing. Also, time-zero residual risk estimates are not relevant to the long-term effectiveness evaluation per SI comments 13 and 14.

217. Page 4-26 states, "Alternative B would be effective in limiting exposure to risks posed by COCs in the sediments and riverbank soils provided the integrity of the caps is maintained. Therefore, the caps would need to be monitored and maintained in perpetuity. Reviews at least every five years, as required, would be necessary to evaluate the effectiveness of any of these alternatives because hazardous substances would remain on-site in concentrations above levels that allow for unlimited use and unrestricted exposure." Per previous comments, it is unclear why the concerns regarding permanence of capping are extensively discussed while the long-term concerns associated with uncontained residuals (given that post dredge covers do not isolate contaminants in residuals) or contaminated sediment that remains in areas too deep to dredge are not similarly assessed.

218. Page 4-27 states, "Tissue PRGs based on the consumption of 19 eight-ounce fish meals per month were developed for use during the post-construction monitoring period to evaluate if contaminant concentrations are decreasing toward PRGs as expected." Prior to EPA developing FS Section 2, it was the LWG's understanding from the 2014 FS technical discussions that EPA did not intend to develop tissue PRGs. Instead EPA indicated at that time that any tissue levels developed would be used as general information to assess the ongoing progress of the remedy long term, but not as performance goals. At the least, this text is unclear whether EPA is using tissue PRGs as cleanup levels or simply as an evaluation tool. The LWG has consistently expressed concern about the development of tissue PRGs because there are known sources (upstream, upland, and surface water in general) of chemical burden in fish tissue that are not related to sediment contamination, and therefore, a sediment remedy cannot be expected to necessarily achieve tissue PRGs by itself. Per the guidance (EPA 2005), PRGs for sediment remedies should be achievable by the sediment remedy itself. EPA's text on page 4-27 is noteworthy because it appears to confirm the LWG's ultimate concern about the use of tissue PRGs, i.e., that EPA would present tissue PRGs as cleanup levels that must be achieved by the sediment remedy alone. The LWG continues to have concerns with EPA's approach to target tissue levels.

219. Page 4-28 states, "PTW that is highly mobile and not reliably contained is identified to be treated ex-situ prior to disposal. All PTW treated ex-situ in this alternative is assumed to be disposed at a RCRA Subtitle C facility. In addition, the Subtitle C disposal facility selected as a representative process option (Chem Waste) uses treatment processes such as cement stabilization or thermal desorption, as needed, to meet LDRs for hazardous waste. Thermal desorption is the representative ex-situ treatment technology." This text is inconsistent with prior text in Sections 3 and 4 in several respects. First, other materials such as RCRA hazardous waste are discussed as

also potentially requiring ex situ treatment, which is not recognized or discussed here. This may be because, despite Section 3 and 4 text indicating the contrary, the cost appendix appears to identify no ex situ treatment or Subtitle C disposal costs for RCRA hazardous waste. Second, the statement that all ex situ treated PTW is disposed of in a Subtitle C landfill is not consistent with the Section 3 alternative development text and Figure 3.3-40, which indicates that some treated PTW may be suitable for Subtitle D disposal (see comment 106). Third, on page 3-33, EPA states, "Removed material that is considered for treatment is assumed to be treated at a nearshore upland facility that will be sited and constructed in remedial design." Thus, it is unclear whether EPA assumed an on-site treatment facility or that treatment would occur at Chem Waste as indicated on page 4-28. This determination has implications for both the implementability and costs of the alternatives and needs to be consistent throughout the FS and cost estimates.

220. Page 4-29 states, "Low-Temperature Thermal Desorption is an ex-situ remedial technology that uses heat to physically separate organic contaminants from excavated soils and sediments." Per past LWG comments pre-dating the 2012 draft FS, LTTD will not effectively treat the typical ranges of PCBs and PAH concentrations found at the Site. (The 2012 draft FS Appendix S also discusses the reasons for this finding.) These COCs are two of the most important and widespread contaminants at the Site. EPA's decision to use LTTD as the representative treatment technology is not clearly supported or necessarily representative of any treatment that may actually take place in RD/Remedial Action (RA). Further, for the same reasons, EPA's statements in this section that LTTD will permanently treat all COCs in the sediments are unsupported.

221. Page 4-30 states for Alternative B, "The period of construction (4 years) is shorter and involves handling of the least amount of dredged materials (872,000 cy) and borrow materials (314,000 cy) than other alternatives." These quantities are inconsistent with Table 3.7-2 and text descriptions in Section 3.

222. Page 4-30 states for Alternative B, "However, Alternative B would require the longest time to achieve RAOs, which would mean the longest impacts to the environment. These impacts would include the impact of not consuming the fish and ability of the tribes to fully engage in their ceremonial practices." Per previous comments, time to achieve RAOs across the alternatives cannot be accurately assessed based on the information included in the FS (see SI comments 13 and 14). In addition, upland and upstream sources will continue to exist for all alternatives and will contribute to limitations in fish consumption and cultural uses, and this factor should also be fully discussed.

223. Page 4-30 states for Alternative B, "Community Protection -There are some short-term risks to the community from exposure to contaminated sediments and riverbank soils during the construction period." Further on the same page it states, "Construction and operation activities may result in temporary noise, light, odors, potential air quality impacts and disruptions to commercial and recreational river users on both sides of the river." While this subsection also contains some additional general statements about community protection, per SI comments 9, 13, and 14, EPA has not conducted an

adequate evaluation of community protection. Further, the characterization that the alternatives "may result" in impacts is misleading, and this terminology is used throughout this subsection. Given the considerable size of all the alternatives, perceptible community impacts will occur for all the alternatives, but the relative magnitude of those impacts will increase as the dredged and transported volumes increase from Alternatives B to G.

224. Page 4-30 states for Alternative B, "This alternative involves dredging of 81 acres and excavation of 9,624 lineal feet of riverbank, with import of approximately 314,000 cy of borrow material." The dredging acreage matches the Section 3 tables (e.g., Table 3.7-2) but is inconsistent with text in Section 4 noted in previous comments.

225. Page 4-30 states, "Construction and operation of a treatment and transport facility may be necessary." The text stating "may be necessary" is inconsistent with Section 3 text indicating that a permanent sediment treatment and transload facility are assumed parts of all the alternatives (e.g., page 3-33, "Removed material that is considered for treatment is assumed to be treated at a nearshore upland facility that will be sited and constructed in remedial design"). Further, the cost estimates include siting of a local transload facility. EPA also mentions water treatment requirements but no description, time to construct, or costs for a local water treatment facility are presented. The community impacts discussion must be consistent with the actual alternatives and all the associated impacts as developed for the FS, which clearly include a local transload facility, sediment treatment facility, and water treatment facility.

226. Page 4-31 states, "COC concentrations in fish tissue are expected to increase during the course of the multi-year construction period; however, this will mainly occur during the in-water work window of July 1 through October 31. Based on experience at other sites [Hudson River (NY), Grasse River (NY)], recovery following construction is relatively rapid, on the order of a few years, and is expected to continue to decrease as contaminant concentrations in sediment decrease." The LWG agrees that fish tissue concentrations have generally been observed to decrease within 2 to 5 years after construction at these and other known sites. However, the paragraph is inconsistent in suggesting that these impacts will mainly occur during the in-water work window. Data from these other sites, as well as the dynamic Food Web Modeling conducted for the 2012 draft FS, clearly indicate that fish tissue concentrations remain elevated throughout a 2 to 5 year period after dredging and do not start to substantially decrease until the dredging is completed and the associated releases stop.

227. Page 4-31 states, "Worker Protection -Alternative B would pose potential risks to site workers through…" The text lists 7 bullets that are aspects of the construction, but does not mention any potential sources of injuries or fatalities. The text then states, "Safety measures and BMPs would be used to minimize the impacts referenced above. Measures such as…" The text goes on to list a few health and safety procedures. The overall implication is that there are some general low level risks to workers that can be mostly avoided through health and safety procedures and compliance with Occupational Safety and Health Administration (OSHA) regulations. This is misleading because the 2012 draft FS quantified the risk of worker injury and death

(using data from construction projects that routinely meet these types of health and safety requirements) for all of those alternatives, and for example, found that Alternative F-r would be expected to cause 51 non-fatal injuries and result in a 21% chance of a fatality (or 2.1 x 10^{-1} risk level). (EPA's Alternatives F and G are even larger than this draft FS alternative.) Given that EPA repeatedly recognizes the uncertainty associated with the determining long-term risks, the short-term worker risks generated by implementing each alternative can be predicted with much greater certainty than the risks predicted from long-term exposure to sediment (e.g., excess cancer risks that represent a fraction of a percent increase in baseline cancer rates). The FS should quantify and clearly state the certainty of worker risks rather than emphasizing only the hypothetical human health sediment exposure risks. EPA's FS ignores the real policy trade-off that is represented by the larger alternatives, which substitutes the hypothetical sediment risks to the fisher population with significantly elevated actual risks to the worker population. See SI comment 14.

228. Page 4-32 states, "Sediment removal may result in short-term adverse impacts to the river, including…," and then states, "Measures and BMPs would be used to minimize the above referenced impacts, including…" The issue here is nearly identical to the issued described in comment 227 regarding worker risks. Specifically, the overall implication is that there are some general low level environmental impacts due to unavoidable dredge releases that can be mostly avoided through BMPs. Further, EPA uses the "may result" terminology, when guidance (Palermo et al. 2008; Bridges et al. 2008) and case studies (as presented in the 2012 draft FS) clearly indicate that dredge releases are unavoidable and will always occur to some degree. Per guidance (EPA 2005) the FS should conduct a site-specific quantification of the dredge releases. See SI comments 9 and 14.

229. Page 4-33 states, "Application of emissions reduction strategies to reduce short-term impacts posed to the environment and promotes technologies and practices that are sustainable according to the EPA Region 10 Clean and Green Policy. Emission reduction could be controlled through BMPs such as…" Similar to other short-term impact comments, EPA does not quantify air emissions, which was conducted in the 2012 draft FS Appendix Ic. EPA then uses the absence of quantitative information to suggest that air emissions can be adequately reduced through the listed strategies and practices. As a result, the text avoids stating the obvious fact that increased air emissions will occur for all alternatives and that the larger alternatives will create substantially more emissions than the smaller ones. This fact should be considered in the alternatives analysis.

230. Page 4-33 states, "Construction operations for this alternative are estimated to take four years. Following the estimated construction time, Alternative B would take the longest time to meet RAOs and PRGs, as the residual contaminant concentrations would be the greater than Alternative B through G, requiring more time for MNR processed to achieve the RAOs and success would be more uncertain. However, some PRGs are met under this alternative and others are met in some areas of the site at the completion of construction, as discussed below." Per previous comments, the relative timeframes to meet RAOs across the alternatives cannot be determined based on the information

included in the FS. See SI comments 13 and 14. Also, EPA uses the same time-zero concentrations in the short-term effectiveness section as was used to develop the residual risks in the protectiveness and long-term effectiveness sections. Per SI comments 13 and 14, EPA cannot reasonably evaluate all these criteria, including both long and short-term outcomes, using the same time-zero metric.

231. Page 4-33 states, "Alternative B would be readily implementable from both the technical and administrative standpoints." Page 4-64 states, "Alternative G would be readily implementable from both the technical and administrative standpoints." This is the exact same text. This does not represent a credible conclusion regarding the relative implementability issues associated with an alternative that involves 818,000 cy of dredging and 200 total constructed acres (Alternative B) as compared to an alternative that involves 9,153,000 cy of dredging and 795 total constructed acres (Alternative G) (all quantities are from EPA's Table 3.7-2). The statement that the larger alternatives (e.g., E through G) are "readily implementable" is unsupported and technically incorrect. EPA makes some statements recognizing that larger alternatives have relatively higher implementation issues, such as, "Given this alternative has the greatest volume of material and project duration for construction, Alternative G would present the greatest challenge to implement" and "Alternative G has a construction period of approximately 19 years, involves construction activities within 795 acres, and thus has the greatest potential for technical difficulties that could lead to schedule delays." However, these short statements do not provide the reader any sense of the real and complex implementation challenges involved with very large sediment remedies. Some of these challenges are detailed in SI comment 10. Although this particular comment pertains to the alternatives screening step in Section 3, the examples in SI comment 10 are entirely applicable, and even more important to address, in the detailed evaluation of alternatives in Section 4.

232. Page 4-33 states, "Implementation of Alternative B would involve dredging 462,000 cy of sediment and the handling and placement of 314,000 cy borrow material." The dredge yardage is inconsistent with earlier text (e.g., page 4-30) and Table 3.7-2 as well as other places within the FS.

233. Page 4-35 states, "If monitoring should fail to detect a release in areas where waste has been left in place in a reasonable time frame, then a release of COCs to the environment may occur. The risk of this occurring is highest for this alternative since it leaves the most waste in place, commensurate with a lower level of protection." This sounds reasonable on the face of it, but this may not be correct. A more detailed analysis of the amounts and concentrations of material left in place and under what conditions would be needed to fully support statements like this. For example, this statement does not consider that for the larger alternatives much greater areas of uncontained dredge residuals (given that post dredge covers do not contain contaminants) would exist, as compared to areas of contaminants that are contained through capping, which is specifically designed to minimize contaminant migration over very long periods. Further, EPA's FS does not propose any rigorous monitoring regime to understand and track movement of contaminants from dredge residuals after

construction, which means that the proposed monitoring is actually less likely to detect releases from dredge residuals than releases from capping areas.

234. Page 4-37 states, "Different modes of transport (barges, trucks and/or rail) for offsite disposal are available. Use of rail would require infrastructure and more coordination than other modes of transport." It is noteworthy that the FS does not include in the alternatives a clear set of assumptions regarding transloading and transport of sediments and treated sediments. The 2012 draft FS contains clear and consistent assumptions on transport. Cost and other issues cannot be accurately assessed without making these relatively fundamental assumptions explicit throughout the FS. For example, the cost estimate appendix assumes that all transport is by trucks. This represents substantially greater worker risks and community impacts than transport by rail, but this fact is not discussed in the short-term effectiveness section. Thus, EPA appears to be making inconsistent assumptions regarding transload and transport across the various evaluation criteria. EPA makes very detailed assumptions in some other cases (e.g., types of precision dredging and bucket sizes) that are not later discussed and that tend to have much smaller relative impact on comparisons between the alternatives relative to the FS evaluation criteria.

235. Page 4-37 states, "Several potential sites were identified in the Portland Harbor area for construction of a transload facility for handling material for disposal in an upland commercial landfill." No details are provided on the sites identified or how they were identified, and the time to construct, which are necessary to conduct a full review of the FS. Similarly, it is unclear that the 140-acre site assumed in the cost estimate appendix is consistent with any of the sites identified, and whether any of these sites would provide sufficient capacity to avoid process bottlenecks that EPA assumes will be avoided (per the construction duration discussion). See SI comment 5 for issues related to bottlenecks and construction durations. Further, the Port of Portland conducted a review of shoreline sites available in and around Portland Harbor and found no available or potentially available sites in the range of 140 acres or larger. Consequently, the implementability of such a transload facility is highly questionable, and alternatives based on this assumption appear unrealistic. The alternatives should be revised to include a more realistic transloading assumption including the associated constraints (e.g., sediment processing bottlenecks) and the effect of those constraints on alternative construction durations presented in Section 3 and the evaluation of implementatbility in Section 4. Finally, it is unclear why this text would first appear in the Alternative B evaluation discussion. This is important information that should be discussed in more detail in the alternatives development process (Section 3).

236. Page 4-37 states, "Other than Alternative A, Alternative B has the lowest cost. Total capital costs for this alternative are $703,906,000 over 4 years. Total periodic costs (excluding 5-year reviews) are $337,522,000, and the overall net present value cost is $790,870,000. The 5-year review periodic costs are $308,000 per event, totaling $1,848,000 over 30 years. Additionally, longer-term costs associated with maintenance and monitoring of contaminants contained on site have been evaluated and estimated to be $596,500,000 ($14,560,000 in present value) over an additional

70 years." The O&M costs presented here differ from those in Table 4.3-1, which are presented as $0 for unexplained reasons.

237. Section 4.3 Comparative Analysis—The LWG comments on Section 4.3 are consistent with above comments on the detailed evaluation of alternatives in Section 4.2 and SI comments 13 and 14. Consequently, these are not all repeated here in detail. In summary, the LWG's concerns with Section 4.3 include:

a. Statements about time to achieve RAOs or long-term outcomes, short-term outcomes or the pace of natural recovery are unsupported, and therefore, the evaluation of alternatives is incomplete.

b. Quantities presented in Section 4.3 are sometimes inconsistent with other areas of the FS.

c. Statements using time-zero concentrations to evaluate protectiveness and long-term effectiveness are not supported, given that time-zero metrics are not relevant to these long-term determinations.

d. The evaluations of benthic risk are inconsistent with the risk assessments and are mostly driven by EPA not including benthic risks as part of the alternative development process in Section 3.

e. Statements about relative achievement of RAOs 4 and 8 (groundwater) as well as RAO 9 (riverbanks), are unsupported for reasons described in Section 4.2 comments.

f. Page 4-67 states, "Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver." However, EPA's evaluation of compliance with ARARs does not actually discuss whether a waiver may be needed or the basis for any waivers if they are needed. This is an important discussion that is missing from the FS (see SI comments 13 and 14).

g. Statements about recontamination potential across the alternatives are unsupported, because no recontamination evaluation (quantitative or otherwise) is presented.

h. The LTTD is not a "proven" technology for large sediment volumes. LTTD is not effective for concentrations of PCBs and PAHs present at the Site per Appendix S of the 2012 draft FS.

i. Statements about the relative reliance of the alternatives on fish consumption advisories are unsupported. A quantitative analysis of long-term fish tissue concentrations (as presented in the 2012 draft FS) would likely show there is very little difference in long-term fish tissue concentrations between the alternatives and that all alternatives would still be above acceptable risk levels in the long term. Further, ongoing upstream sources will continue to contribute to unacceptable fish tissue risks from basin wide contaminants (e.g., mercury and PCBs) requiring the on-going need for fish consumption advisories, regardless of the effectiveness of the sediment alternatives. Thus, it does not seem likely that larger alternatives would be less reliant on fish consumption advisories, as EPA states.

j. Page 4-69 states, "However, Alternative B would have the longest impact to the community and environment until RAOs are met, while Alternative G would have the shortest impact." This statement is unclear and unsupported. Per SI comments 13 and 14, EPA provides no information that evaluates the balance of overall short-term effectiveness as indicated by the combined assessments of 1) the magnitude of construction impacts and risks and 2) time to achieve RAOs. Also, the text raises the question, measured by what? Year 0 for Alternative G is nearly two decades after Year 0 for Alternative B. Thus, just using the information presented in the FS, this statement appears likely to be false or at least highly uncertain.

k. Much emphasis is placed on measures to minimize and mitigate short-term impacts, which does not constitute an actual evaluation of the expected impacts from the alternatives with those measures in place. There is no quantitative evaluation of the actual expected short-term impacts to the community, workers, or the environment (including dredge releases and air emissions).

l. The implementability discussion indicates that all alternatives are readily feasible and implementable, which is a misleading characterization of the large and obvious incremental implementability differences from Alternatives B through G.

238. Page 4-72 states, "Reducing and increasing the construction duration assumptions has a relatively significant effect on the total present value cost compared to the other sensitivity analysis scenarios." It appears this conclusion is not supported by the cost sensitivity information in Appendix G. In Appendix G, EPA keeps all of the capital costs the same and then divides those same costs evenly over a 50% longer or 50% shorter construction durations, which results in virtually no net change in capital costs (not including the net present value calculation). EPA then applies the discount value in the net present value calculation for these same expenditures over the increased and decreased periods to conclude that longer construction durations are less expensive on a net present value basis. Thus, the only changes in costs are caused by the net present value discounting assumptions, which is not a meaningful analysis of impacts of construction duration on costs. By this logic, all sediment remedies should be extended as long as possible in order to "reduce" the costs of the construction. Also, on page 241 of Appendix G EPA states that, "The total present value cost was reduced by a range of approximately 5 and 17% for Alternatives B and G, respectively, with a 50% decrease in construction duration compared to the baseline." This conclusion is the reverse of the actual results shown in Appendix G Exhibit 4 (page 262 to 264), which indicates that the net present value cost increases with a 50% decrease in construction duration. For an appropriate cost duration sensitivity analysis, EPA should adjust the

total capital costs because there would be more mobilizations/demobilization, longer construction management and project management efforts, and additional lease costs (and other seasonal costs) for the transload facility. Using such an approach, the LWG estimates that the costs of longer construction durations will increase non-discounted costs by approximately 10 to 20% where longer durations are assumed. Assessing the effect of duration on costs is better understood by evaluating non-discounted costs.

239. Tables 4.3-1 and 4.3-2—The contents of these alternative summary tables are summaries of the Section 4 text conclusions. These tables are unsupported and technically inaccurate for reasons provided in previous comments and SI comments 13 and 14. In general, both tables rely on subjective and unsupported statements from the text and therefore are also highly subjective. Also, quantities provided are often inconsistent with Section 3 text and tables similar to the quantity inconsistencies noted previously for the Section 4.3 text.

240. Appendix C, Section C2.1 (Navigation Channel and Future Maintenance Dredge Areas) – This section should note that the LWG "site use survey" did not include any non-LWG members. For non-members, maps of docks were used to approximately define likely or potential future maintenance dredge areas and may be inaccurate with regards to actual or expected future site-specific uses in these areas.

241. Appendix C, Section C2.2 (Final Remedy Areas) – This section indicates that the McCormick and Baxter site was excluded from the analysis. Page 3-7 of the main text indicates that potentially the Gould site was also excluded from the analysis (in addition to the McCormick and Baxter Site.) The text in these two areas should be made consistent with actual the methods used.

242. Appendix C, Section C2.4.1 (Wind and Wake Generated Waves) – Much of the text, tables, and figures appear to come directly from the 2012 draft FS. An exact comparison of the text and other materials here to the information in the 2012 draft FS has not been made. However, to the extent that any of these materials have been changed, the LWG may not agree with those changes.

243. Appendix C, Section C2.4.2 (Shear Stress on Bottom Sediments) – See comments 35 and 51, as well as SI comment 19q, regarding technical issues and inconsistencies with this analysis. Also, it appears that some of the text, tables, and figures come directly from the 2012 draft FS. An exact comparison of the text and other materials here to the information in the 2012 draft FS has not been made. However, to the extent that any of these materials have been changed, the LWG may not agree with those changes.

244. Appendix C, Section C4.2 (Debris) – This section describes methods to define densities of debris that were considered significant relative to technology assignment scoring. The method described here appears arbitrary, although the description is very detailed. For example, how did EPA determine that this specific density of debris was significant relative to the implementability of capping or dredging in these areas while slightly lower debris densities were not?

245. Appendix C, Section C4.3 (Propwash) – Much of the text, tables, and figures appear to come directly from the 2012 draft FS. An exact comparison of the text and other materials here to the information in the 2012 draft FS has not been made. However, to the extent that any of these materials have been changed, the LWG may not agree with those changes.

246. Appendix D (Principle Threat Waste Cap Modeling) – Overall, use of this modeling in the PTW determinations in not technically appropriate, as described in SI comment 2. Per other SI comments, there are technical inaccuracies and inconsistencies with other specific aspects of this analysis. For example, because the LWG disagrees that EPA's PRGs are correct per SI comment 17, the LWG disagrees with the water PRGs used in this cap modeling analysis. Not all specific technical issues and inconsistencies with the methods or results used in Appendix D are necessarily repeated in these comments on Appendix D.

247. Appendix D, page 1 states, "EPA guidance for PTW (USEPA 1991) states that source material may be safely contained and that treatment for all waste will not be appropriate or necessary to ensure protection of human health and the environment, or cost effective." The LWG agrees with this statement. Therefore, it is unclear why EPA then determined in the main text that, contrary to guidance, waste that was determined to be reliably contained through this analysis required treatment or why such treatment provided any additional protectiveness or is judged to be cost effective. EPA's approach of defining material that is reliably contained as PTW is inconsistent with the PTW guidance.

248. Appendix D, Section D1.0 (Principal Threat Waste Cap Modeling) – This section describes that five chemicals were selected with "various chemical characteristics" and that two of the chemicals selected were "more mobile." This description is insufficient to understand why these five chemicals (and not other potential chemicals) were included in the analysis.

   a. This section also notes that Active Cap Layer Model v4.1, a Microsoft Excel-based model developed by Danny Reible of Texas Tech University, was used. Based on an August 13, 2015 conference call, it appears that the wrong version of the model was referenced here. The version noted here is outdated.

   b. This section notes that "A fraction organic carbon (foc) of 0.017 was used, representing the average organic carbon content of surface sediment at the site." This fraction was used to convert bulk sediment chemical concentration results to porewater concentration results. Use of a Site-wide organic carbon value is incorrect. The actual organic carbon content associated with the sample in question should have been used to calculate a porewater estimate that is consistent with the actual Site conditions from where that sample was collected.

   c. This section notes that 5% activated carbon was assumed for Phase 1 modeling efforts based on two other projects. Also, for Phase 2, EPA used "the active layer loading of the augmented cap was set to 0.48 lb/ft2/cm, and a low permeability layer limiting seepage velocity to 0.3 cm/day was assumed." No references are provided for the Phase 2 parameter values. A wide range of activated carbon and organoclay application rates exist across both existing pilot and full-scale active capping projects. It is unclear what relevance these particular application rates have to the determination of reliably contained at this Site. For example, if the 0.46 lb/ft^2/cm rate cannot contain material in question but a slightly higher rate would, why is that material not considered reliably contained as well?

d. See SI comment 2b regarding EPA's inappropriate use of generalized seepage rates in this analysis.

249. Appendix E (Potential Water Quality Impacts from the Terminal 4 Confined Disposal Facility) – Overall, it is unclear whether the information contained in this appendix was considered in the main text alternative development or evaluation steps. For example, this appendix is not referenced anywhere in Sections 3 and 4. Also, it appears that much of the text, tables, and figures in Appendix E come directly from the 2012 draft FS. An exact comparison of the text and other materials here to the information in the 2012 draft FS has not been made. However, to the extent that any of these materials have been changed, the LWG may not agree with those changes.

250. Appendix F (HST Evaluation) – This appendix provides details of the bathymetry data time series comparisons conducted by EPA. For reasons detailed in comment SI comments 8c and 8d, the methods and results of this comparative analysis are technically incorrect. As noted in those comments, two primary problems with EPA's analysis are: 1) the analysis is conducted inappropriately only on the smallest possible spatial scale; and 2) the analysis focuses on comparisons between individual pairs of bathymetry time series data and disregards the overall bathymetric changes indicated by the entirety of the time series data. Also, the appendix appears to include highlights of text that has yet to be completed.

251. Appendix G (Detailed Cost Evaluation) – Detailed comments on this appendix are provided in SI comment 16. However, the LWG has not had time to conduct an exhaustive review of the appendix to identify all instances of potential errors, inconsistencies, or disagreements with technical approaches. The following additional issues were noted since the time the SI comments were submitted:

a. EPA does not include any costs for Oregon Department of State Lands (DSL) land lease or related costs for any of the alternatives. The 2012 draft FS included estimates of these DSL costs for the draft FS alternatives. Consequently, this appears to be another area where EPA underestimates the total costs of all of the alternatives.

b. EPA indicates in Sections 3 and 4 that material treated by thermal desorption may be suitable for Subtitle D disposal in some cases (e.g., Figure 3.3-40), but it appears that Appendix G assumes that all such treated material is disposed in a Subtitle C facility. It is unclear which disposal decision is consistent with EPA's intended methods.

c. EPA conducted a cost sensitivity analysis of five cost elements. Regarding the duration assessment, EPA kept the capital costs the same and then divided them evenly over a longer or shorter duration. This appears to be an incomplete evaluation of the impact of durations on costs. A more accurate approach would be to adjust the total capital costs because of more mobilizations, longer construction management, longer project management, and a longer lease for the offloading facility, etc. Regarding volumes, EPA varied the assumed dredge volume by factors of 1.5 to 2.0 beyond the factor of 1.75 that was used for the rest of the cost appendix. However, EPA kept all of the other capital costs not related to dredging and the periodic costs constant regardless of these volume variations, which is inaccurate.

d. EPA used 2012 draft FS general unit costs for sheetpiling that are based on shallow water sheetpiling (i.e., single sheets of piling driven into the sediment). EPA then applied those costs to situations that may be well in excess of 50 feet of water depth. Per SI comment 11, water depths in excess of 40 feet (or perhaps shallower in some instances) would require the use of king piles or cofferdams, which will be much more expensive than the sheetpile estimates used in Appendix G.

e. EPA used a number of LWG unit rate calculations from the 2012 draft FS, which were based on 2010 costs. EPA increased those 2010 rates by 12.5%, citing the time difference between 2010 and now as the reason for the increase. EPA cites Civil Works Construction Cost Index System (CWCCIS) but the appendix does not say how the 12.5% factor was determined or appropriate for that time period.

f. It appears that EPA used Oregon Department of Transportation (ODOT) 100 for “beach mix.” This material has a D50 of 7.5 inches and is crushed rock. This material appears inconsistent with the assumed habitat benefits of “beach mix,” as described in Sections 3 and 4.

g. EPA assumes truck transport to the Subtitle C landfill at Chem Waste and rail transport to Roosevelt land fill for Subtitle D disposal. The main text does not discuss any of the potential community or worker health and safety impacts associated with these assumptions.

h. In Appendix G, there is a line item for mitigation in the upfront summary sheets by alternative, but the mitigation cost per acre changes for each alternative and it is not clear why the costs are not consistent. In contrast, in the backup spreadsheets, it states that mitigation costs are the “average cost of two Lower Duwamish projects presented and referenced in Table 6.1-1 by Anchor QEA (2010),” and in these sheets, the cost is consistently the same per acre, per alternative, which is inconsistent with the upfront summary sheets.

i. EPA's estimated “total periodic costs” for long-term O&M, monitoring, five-year reviews, and institutional controls range from $337 million to $977 million across the alternatives. However, Appendix G (and EPA’s FS in general) provides no clear description of the scope of that program (e.g., the number and type sediment, surface water, and fish tissue samples for each monitoring event). Additional details of the overall long term monitoring program envisioned should be provided, similar to the information provided in Appendix T of the 2012 draft FS.

j. The use of a 7% discount rate for the FS sets an unrealistic expectation and may impair potentially responsible parties' (PRPs) ability to maximize funding sources, especially insurance proceeds, for the alternatives. As the LWG noted in our SI comments, the 2012 draft FS used a 2.3% discount rate, which is consistent with guidance and precedents at other relevant sites (e.g., the Duwamish FS). The 2015 equivalent discount rate is 1.5% (OMB 2015). EPA guidance states that a market rate much lower than 7% should be used to set a financial assurance (FA) amount (EPA 2015), which means PRPs will have to post funds in long-term FA trusts or bonds in sums much higher than the present value of the alternatives presented in the FS. Additionally, most, if not all, PRPs will look to their insurance carriers to fund the PRP's share of liability. Based on the experience of LWG members, insurance carriers will only agree to pay the significant dollars necessary to fund PRP liabilities in exchange for a full and complete release of claims. EPA's use of a 7% discount rate in the FS may well result in insurance carriers agreeing only to pay a heavily discounted sum on the presumption that the PRP will be able to earn significantly over market rates on moneys held for extended periods of time while the PRP is awaiting paying out funds for alternatives with more extensive construction durations. The result of this scenario is that many alternatives will either be significantly underfunded or PRPs will be required to aggressively invest funds thereby placing the funds at risk of market fluctuations.

252. Appendix H (Residual Risk Evaluation) – As detailed in SI comments 13 and 14, EPA's residual risk assessment is inappropriate for long-term effectiveness or protectiveness evaluations because all the risk estimates are based on time-zero sediment concentrations. Also, the spatial scales used were inconsistent with the risk assessments per SI comments 17 and 19. Also, as indicated in those comments, the residual risk assessment results for the no action alternative are generally much higher than similar risk estimates for baseline conditions from the BLRAs. This indicates EPA's methods are inconsistent with the BLRAs and generally appear to overestimate all of the time-zero concentration-based residual risks. Also, per comment 166 additional residual risk assessment information cited in the main text as residing in Appendix H is not actually present in Appendix H. The following additional specific issues were identified in Appendix H:

a. The first page states, "For the development of post remediation sediment concentrations, the FS assumed that the lower two inches of the thin layer sand cover, in-situ treatment cover or post-dredge residual cover is 15% of the surface sediment concentration or the post dredge residual concentration as a result of mixing during placement. Averaging this concentration over the entire 12" thickness of the thin layer sand cover, insitu treatment cover or post-dredge residual cover results in a surface sediment concentration of 2.5% of the surface sediment concentration." EPA's subsequent text indicates this assumption was also used for capping areas. Although this may be a reasonable simple estimate of post remediation concentrations for post dredge covers, EMNR and in situ treatment, this assumption is not relevant for capping areas. Also, the rationale for the simple method is not provided. Both the method and the amount of rationale provided in Appendix H differ substantially from EPA's 2013 memorandum requiring more detailed dredge residual and sand cover estimation methods than those provided in the 2012 draft FS (see EPA memoranda dated May 24, 2013, for the dredge releases/residuals, prepared by Paul Schroeder and Karl Gustavson of the U.S. Army Engineer Research and Development Center [ERDC]). As a result, EPA's methods appear more simplistic than the 2012 draft FS methods that EPA previously indicated were too simple. The reasons for not using the EPA May 2013 memorandum methods are unclear.

b. Some text is highlighted in the appendix, indicating that the appendix is not yet completed.

253. Appendix I (Rolling River Mile Curves) – This appendix contains 140 pages of graphs of rolling river mile concentrations for various chemicals and on various spatial scales. Per comment 190, the graphs appear to contain comparisons to upstream sediment trap data. The LWG strongly encourages the EPA to expand upon the lines of evidence used in these types of comparisons and explain the rationale associated with the comparisons in much more detail in the FS. Also, per SI comments 13 and 14, EPA's time-zero concentration graphs are inappropriate for long-term effectiveness or protectiveness evaluations because all the concentration estimates are based on time-zero sediment conditions. Also, the spatial scales and comparative PRGs used in these graphs were inconsistent with the risk assessments per SI comments 17 and 19.

254. Appendix J (Compensatory Mitigation Requirements under CWA Section 404). As described in SI comments 16d and 7, the methods used for mitigation estimates provided in this appendix are not technically correct because the methods assume that each acre impacted by an alternative provides full habitat function and that the function is completely lost due to the dredging or capping activity. These assumptions are not accurate for either existing Site habitat conditions or the habitat functions likely provided by EPA's alternatives. Further, EPA assumes that EPA's alternatives provide no habitat function whatsoever, which is clearly false. The Appendix J approach is inconsistent with the additional technology assignment rules (as described in SI comment 7) that attempt to add habitat features to the alternatives. Although those habitat features are briefly discussed in Appendix J, they are not actually factored into the simplistic mitigation analysis presented. Also, EPA does not appear to consider the much more robust mitigation estimation approach provided in Appendix M of the 2012 draft FS, which included some of the same methods that Appendix J recommends should be further explored in remedial design.

255. References Section—The following references are listed in the references section but are not referenced in Section 4:

   a. Ghosh et al. 2011.

   b. Tomaszewski et al. 2008

   c. USEPA 1988

   d. Zimmerman et al. 2005

   The following references are referenced in Section 4 but are not listed in the References section:

   a. EPA and ODEQ 2002

   b. Magar et al. 2009

   c. Schroeder and Gustavson 2013

   d. May and Burger 1996

   e. Burger et al. 1999

   f. Kirk-Pflugh et al. 1999, 2011

   g. Port of Portland 2011

   h. Jay 2012

   i. Hayter ??

3 REFERENCES

Anchor QEA 2012. Draft Engineering Evaluation/Cost Estimate Gasco Sediments Cleanup Site. Prepared on behalf of NW Natural. May 2012.

Bridges, T.S., S. Ells, D. Hayes, D. Mount, S. Nadeau, M. Palermo, C. Patmont, and P. Schoeder. 2008. *The 4 Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk*. U.S. Army Corps of Engineers Engineer Research and Development Center. TR-08-4.

EPA (U.S. Environmental Protection Agency). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*. Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540/G-89/004. OSWER Directive 9355.3-01. October 1988.

EPA. 1991. *A Guide to Principal Threat and Low Level Wastes*. Office of Solid Waste and Emergency Response. Superfund Publication 9380.03-06FS. Washington, D.C. November 1991.

EPA. 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. EPA Office of Solid Waste and Emergency Response. §2.4.1 OSWER 9355.0-85. December 2005.

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OMB (Office of Management and Budget). 2015. 2015 Discount Rates for OMB Circular No. A-94. Memorandum for the Heads of Departments and Agencies. From Shaun Donovan, Director. January 21, 2015.

Palermo, M., S. Maynord, J. Miller, and D. Reible. 1998. *Guidance for In-Situ Subaqueous Capping of Contaminated Sediments*. EPA 905-B96-004, Great Lakes National Program Office.

Palermo, M., P. Schoeder, T. Estes, and N. Francingues. 2008. *Technical Guidelines for Environmental Dredging of Contaminated Sediments*. U.S. Army Corps of Engineers Engineer Research and Development Center. TR-08-29.